

ARCHIVES OF OTOLOGY.

A BRIEF REPORT OF FORTY RADICAL OPERATIONS FOR CHRONIC PURULENT OTITIS AND COMPLICATIONS, WITH REMARKS.¹

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FROM October 1, 1900, to October 1, 1902, 45 radical operations were performed in the ear department of the New York Ophthalmic and Aural Institute; of these 40 were performed by Dr. Jordan and myself. They represent the subject of these remarks and include all of the operations of this kind performed by either of us during this period of two years; they are consequently not selected cases.

These 40 cases of chronic otorrhœa may be classified according to the symptoms and pathological findings at operation as follows:

	—Knapp—	—Jordan—
a. 5 cases of caries.....	4, 6, 7, 9	24
b. 11 cases of caries with severe symptoms.....	1, 5, 8, 10, 11, 19	23, 26, 30, 31, 35
c. 11 cases of caries with acute exacerbation or acute retention symptoms.....	2, 3, 12, 13, 15, 21	22, 27, 29, 39, 40
d. 6 cases of caries with labyrinth fistula.....	14	32, 33, 36, 37, 38
e. 4 cases of intracranial complications.....	16, 17, 18, 20	
f. 3 secondary operations.....		25, 28, 34

This classification is necessarily more or less arbitrary; the symptoms of the various groups frequently differ only in degree, yet they are serviceable for purposes of description.

¹ Read at meeting of the Otological Section, New York Academy of Medicine, February 16, 1903.

The following are the noteworthy features in these cases. (The case histories will be published at the end of the paper.)

In the *first group*, cases of simple caries, the operation was performed in two (4, 9) on account of an almost complete stenosis of canal. An imperfect operation had been done elsewhere without a plastic, the disease remained and the canal was stenosed. In one of these (9) a small exostosis was found on the external semicircular canal, the patient had been totally deaf for a number of years, and the medial tympanic wall was absolutely smooth and bony without any details, the window-niches being obliterated. In the third (6) the patient suffered from caries in the posterior segment of the tympanum and antrum associated with profuse and obstinate granulations which resisted repeated minor operations. At the radical operation after the antrum and attic had been cleaned out, every attempt to curette the posterior tympanic wall was followed by a facial convulsion so that this area remained untreated. The case healed promptly except for this area, which to-day after 14 months though very much contracted in size is still unhealed. In the fourth case (27) after long conservative treatment the Stacke operation was performed, when at ossiculectomy the ossicles were found normal and the antrum full of granulations. The radical operation was done in one case of caries to improve the hearing at the earnest solicitation of the patient. Bone conduction was reduced. No stapes was found. Skin grafts were inserted and the wound healed rapidly but the hearing was not improved.

In the *second group*, caries with severe symptoms consisting in headache and nausea, there were five cases with defect in the tegmen antri. In one case (10) the stapes was accidentally removed during the operation; this was followed by no ill-effect except that the hearing, which previously had been good, was very much reduced. One (8) was characterized by unusually slow epidermization; healing took place after eight months though now occasionally there is slight moisture at the round window. The following cases in this group are not entirely healed though free from symptoms, Case 1 is still under treatment for suppuration coming from

the tympanic floor, where there is quite a recess. The outer wall of the hypotympanic recess had not been trimmed down at the first operation. In another (5) a fistula remains in the posterior tympanic wall just back of the oval window. At operation an unusually deep recess was found under the aqueductus Fallopii. A scab forms, covering a small drop of fetid pus. The third (23) has an apparent involvement of the labyrinth; the stapes is in position and intact but a copious thin discharge is flowing from the niche of the round window. There are no other labyrinth symptoms.

In the *third group* are included those cases where an acute reinfection of the antrum has taken place giving mastoid symptoms, and cases where thin fluid pus is found retained in the antrum and aditus by granulations, a stenosed canal, or cholesteatoma, causing marked symptoms. One case (2) presented a subperiosteal abscess, a perforation through the mastoid cortex, a large epidural abscess, and cholesteatoma. The retro-auricular wound was left open and subsequently closed at a second operation. In another case (3) there was so much destruction in the mastoid that the wound was kept open, for purposes of proper dressing. The healing was very slow owing to remaining necrosis. Grafts were inserted. A secondary operation to close the posterior wound was kept in view but the patient ceased attendance. In one case (24) the cholesteatoma filled the whole mastoid process and had perforated the cortex and the sigmoid sulcus. In Case 29 the destruction from cholesteatoma was so extensive that not only the sinus and dura were exposed but also the jugular bulb and the maxilla joint by erosion of the floor of the tympanum and anterior meatal wall. In this case the patient had had no discharge from her ear for the last ten years and the canal was tightly packed with an epidermis plug.

In the group of cases with *labyrinth fistula* there was a case (14) of a man with a history of long standing otorrhœa, who suddenly became very ill and suffered from such intense vertigo that the head could not be lifted from the pillow. The antrum contained pus, granulations, and cholesteatomatous masses and there was a large defect in the anterior half.

of the external semicircular canal. The hearing was not much impaired and there was no nystagmus. Healing uneventful; after operation no further vertigo. In the other cases (32, 33, 36, 37, 38) cholesteatoma had destroyed the osseous capsule of the horizontal semicircular canal at one point and irritated or infected the membranous organ. In three (32, 37, 38) of these the symptoms were so characteristic that a positive diagnosis was made before operation; in the other two (33, 36) the presence of a fistula was anticipated. The classical symptoms are vertigo and nystagmus, the former increasing when the head is turned toward the affected side, nystagmus becoming more distinct when the eyes are turned in the opposite direction. In one case of double radical operation (32, 33) where the nystagmus was increased when the eyes were turned in either direction, both horizontal semicircular canals were found perforated. In these cases the symptoms of unbalance disappeared within a few months after the operation. Of the last five cases operated upon, two had been totally deaf for a long time, two heard about $\frac{1}{60}$, one had become deaf for the loudest voice recently; the three last cases recovered a fair hearing ($\frac{10}{60}$ — $\frac{20}{60}$).

We next come to the group of *intracranial complications*. In one case the extradural abscess in the posterior fossa was situated internal to the sigmoid sulcus, secondary to disease of the inner wall of the antrum. The abscess was evacuated at operation, but a fatal meningitis had already set in. In the second case the bone was affected in the same locality, the neighboring dura was inflamed, there was a phlebitis of the cerebellar wall of the sigmoid sinus; the patient died of meningitis. The third was a case of jugular bulb thrombosis secondary to an extradural abscess in the sigmoid sulcus. Notwithstanding resection of the lateral sinus and ligation of the jugular vein, the patient suffered from a very severe pyemia of nine weeks' duration and multiple metastases, terminating in recovery. In the fourth case the patient suffered from symptoms of antral retention due to a cholesteatoma and granulations; there was caries of the vestibule. After a temporary improvement symptoms of meningitis

and abscess of the brain developed. At autopsy meningitis was found present, presumably secondary to a cerebellar abscess in the flocculus, the part of the cerebellum adjoining the internal auditory meatus, which had ruptured into the fourth ventricle.

Secondary operations were made in three cases (25, 28, 34) where a thorough radical operation had previously been performed elsewhere with large permanent postauricular opening and careful and uninterrupted after-treatment had been followed. One (28) healed after the very deep hypotympanic recess was opened up by trimming down the floor of the osseous canal. In one (34) a fistula was found apparently leading into the vestibule. The fistula healed but there remains a very slight but persistent discharge from the niche of the round window. In the third where the Eustachian tube is stenosed about $\frac{1}{2}$ inch from the tympanum, discharge continues from this very narrow and blind ending canal—due probably to caries of the osseous Eustachian tube.

The fatal result in three cases was due to conditions found present at operation and for which the operation itself is not responsible.

Method of operating: The operation began by exposing the middle-ear cavities in the quickest and most direct manner. This, in most cases, was according to the Zaufal-Küster method of removing the posterior and superior bony walls of the meatus until the antrum or attic was reached; or in an inaccessible antrum the original Stacke procedure by first removing the outer attic wall was followed. In nearly all cases the mastoid process was sclerosed. The chisel was used, occasionally supplemented by use of the burr, especially to smooth the bony surface at the end of the operation. The inner extremity of the posterior meatal wall was removed as completely as possible, especially when the posterior tympanic recess was well marked; the lower margin of the annulus tympanicus was removed in the presence of a deep hypotympanic recess.

The plastic operation was made according to Ballance, Koerner, or Panse. Due care was taken to dissect out the cartilage in the conchal part of flap.

Skin grafting was practised either secondarily according to Ballance (4 times, with 3 successes), or grafts were secondarily inserted through the meatus (2 cases, local anaesthesia), or an immediate skin graft (2 cases) was placed over the facial spur and promontory wall.

Complications in the healing process:

Erysipelas in four cases. In Case 1 on the 13th day after operation the anterior extremity of the cutaneous incision showed some infection. An attack of migratory erysipelas followed, the temperature remained between 105° and 106° for five days, then slowly dropped to normal in three more days. The local signs were very slight and the case gave us considerable uneasiness from fear of pyemia until the temperature fell. Two other cases (26, 31) were complicated with erysipelas, which however did not interfere with the epidermization of the cavity, in fact in one case (15) it seemed to facilitate the after-treatment. The granulations ceasing to grow, required no packing whatever and the epidermis extended under the scab over the whole cavity.

Perichondritis in one case. This complication may be attributed to two causes; primarily, because the exposed cartilage in the concha was not thoroughly dissected out, and secondarily, because the excision of the infected cartilage was delayed too long.

No facial paralysis, temporary or permanent, was observed.

After-treatment consists in very careful packing of all the recesses of the tympanum with small pieces of gauze, changed daily at first, later at longer intervals; at the same time there is no question but that the packing can be kept up too long and retard the healing process. The after-treatment is most important for the success of the operation (the operation in fact is but the beginning), and should be done by the operator himself, or by one versed in the technique of the operation. The exuberant granulations are to be removed by any gentle method, small scissors, knife, or snare. The forcible use of the curette must be avoided. A healthy condition of Eustachian tube is important. Adenoids, even if small, should be removed.

Duration of Healing.—Statistics on this point are of but relative value, as everything depends on the local conditions found present, and the indications drawn by the operator.

In my 18 cases, 1 ran away,
4 unhealed,
13 healed in from 6 weeks to 8 months,
averaging $3\frac{1}{2}$ months.

In Dr. Jordan's series of 16 cases, omitting the secondary operations, 1 stayed away,
1 unhealed,
14 healed in from 4 to 13 weeks, averaging $8\frac{1}{2}$ weeks.

Hearing results (tested recently):

Knapp: Improved	7
Stationary	4
Worse	3
Jordan: Improved	10
Stationary	5

The cause for non-healing is caries in the tympanum, and in these cases persistence of suppuration either in the posterior recess, labyrinth wall, or floor.

In conclusion, a word as to indications. In this small series of cases the attempt was made to draw the indications very close; there have been no prophylactic operations.

REPORT OF CASES.

(Knapp, 1 to 21; Jordan, 22 to 40.)

CASE I.—Chronic purulent otitis, cerebral symptoms.

G. L., seventeen years old; right otorrhœa since childhood, continuous; headache, nausea, and vomiting on its cessation. No other symptoms. $H = \frac{2}{3}$.

Mt total defect; inner wall of tympanum smooth and healthy. Pus comes down from attic.

Operation, October 22, 1900. Sclerosed mastoid, antrum enlarged and filled with granulations, upper wall defective, attic enlarged, caries pronounced in the posterior segment of the tympanum. Bone smoothed with burr. Plastic according to Ballance.

Subsequently no unfavorable symptom, except slight headache, until November 3d, when the temperature rose; there was some infection in the upper and lower parts of the wound. The temperature remained up on the following day; considerable headache was complained of, there was swelling and redness over the parotid region, with an herpetic eruption, which extended to various parts of the face and scalp. The temperature remained between 105° – 106° for four days without chills, then gradually came down in three more days. The general conditions were sufficiently satisfactory to permit the skin grafting on November 23d, when the wound was reopened, curetted, and covered with skin grafts according to Ballance. The grafts in the antrum and tympanum had all taken, except that there has remained some secretion from the bottom of the tympanum. The patient is still under treatment. The hypotympanic recess is very deep; its outer wall was not sufficiently trimmed down at the operation. There are no symptoms.

CASE 2.—Chronic purulent otitis, acute exacerbation, epidural abscess.

L. L., thirty-six years old. Old otorrhœa, without symptoms until, November 14, 1900, the mastoid process became swollen and tender. Discharge had ceased.

Mt almost total defect. Dried pus and scales coming down from the attic; granulations over posterior wall.

Operation, November 16th. A periosteal abscess was evacuated, and a perforation was found in the cortex about 2 cm behind the meatus. This opened into a very large cavity continuous with the antrum; the dura was found exposed to a great extent and covered with healthy granulations. The aditus and tympanum contained granulation-tissue and cholesteatomatous masses. There were no ossicles. The posterior wound was left open for dressings.

The subsequent course, beyond some vertigo, was uneventful. On February 14th, a Ballance plastic was done, and the posterior wound united. On April 22d, the wound cavity was perfectly healed. Last seen December 13, 1902; the ear was dry, H = $\frac{1}{8}$.

CASE 3.—Chronic purulent otitis, mastoid fistula with reinfection.

G. S., seven years old, had been operated on some months ago for acute mastoiditis. Returned January 29, 1901, with mastoid red and swollen, and very tender. The boy appears very sick. Meningeal symptoms. Facial paralysis (?).

At operation so much disease was found at the depth of the fistula that the entire posterior wall was removed and the middle ear, which contained granulations, was cleaned out. The Panse plastic was done and the wound was treated from the back.

The case progressed very slowly, owing to some ostitis in portions of the mastoid wound. The process of epidermization did not progress. After repeated curetting and the insertion of skin grafts the condition was satisfactory and a closure of the large retroauricular opening was kept in view but the patient ceased attendance.

CASE 4.—Chronic purulent otitis, mastoid fistula, stenosis of canal. No symptoms.

J. G., twenty years old, had been operated on elsewhere for long-standing otorrhœa. The ear continued to discharge and the mastoid wound would become swollen, the opening discharging pus from time to time. No other symptoms. $H = \frac{2}{8}$. The canal is stenosed with granulations, evidently coming from the region of the antrum.

Operation, April 2, 1901. The upper and posterior meatal walls had been incompletely penetrated, making a gutter which led to the antrum and middle ear. These cavities were filled with granulations and cholesteatomatous masses. The antrum was fully exposed, the posterior and superior wall of the canal removed with the burr, as the bone was unusually hard. The floor of the middle fossa was very low, especially externally. The floor of the tympanum contained some whitish material and there was quite a cavity beneath the facial canal in the posterior wall of the tympanum. This was carefully cleaned with a spoon. The membranous canal had grown together at the apex with considerable perichondritis and adhesions. The Ballance plastic was done, closing the retroauricular opening, except above.

Healing progressed satisfactorily and the ear was completely dry at the end of June of that year. When seen last, on October 10th, the ear was completely dry and the $H = \frac{2}{8} +$, somewhat better than before operation.

CASE 5.—Chronic purulent otitis, caries with severe symptoms.

A. C., twenty-two years old, had a discharge from the ears for many years. In the right, total defect, the hammer is visible posteriorly, and there is a large granulation springing from the bony wall. Attacks of severe headache and vomiting. $H = \frac{2}{80}$.

Operation, April 11, 1901. With the burr, the mastoid being unusually sclerosed. The antrum contained thin pus, and was quite a large cavity with a defect in the upper wall, exposing the dura. On freely laying bare the aditus an area above and back of the external semicircular canal was found diseased. The tympanum was fairly healthy, except a slightly developed recess in the posterior wall and a carious region on the promontory. Ballance plastic.

The healing progressed without any disturbance, except that it was unusually slow. The granulations were unusually flabby, and epidermization very slow. Finally the wound healed in about three months, except a region in the posterior wall of the tympanum, which even now from time to time shows a slight discharge. The symptoms have all been relieved and the hearing is improved. $H = \frac{8}{16}$.

CASE 6.—Chronic purulent otitis, caries.

R. V., fourteen years old, had right otorrhœa for many years. Polypi and granulations have been frequently removed without permanent benefit. No other symptoms, $H = \frac{1}{16}$. The polypi appeared to be attached up and back toward the antrum.

Operation, November 1, 1901. The antrum was not very accessible, and the lateral wall of the attic was first removed. The aditus was found enlarged, also the antrum. The latter cavity was lined with perfectly smooth ivory bone and contained cholesteatomatous material with some odor. Granulations in the middle ear appeared springing from the labyrinthine wall and some from about the oval window. The stapes could not be identified. There was considerable caries of the posterior segment of the tympanum. On attempting to treat this, the slightest contact with an instrument caused immediate facial convulsion. Nothing further could be done. Ballance's plastic.

Healing took place uneventfully, except about the descending portion of the facial nerve. This area has diminished very much and is now, after two years, almost healed. The boy is unquestionably tuberculous. $H = \frac{2}{16}$.

CASE 7.—Chronic purulent otitis, caries with loss of hearing.

L. L., fifty-four years old. Old-standing otorrhœa. Hearing in this, the only good ear, failed nine months ago. Bone conduction diminished. Upon earnest solicitation it was decided to do a radical operation with the possibility of improving the hearing.

Operation, December 10, 1901. The outer wall of the attic was first removed with a burr and the antrum exposed, showing caries and granulations. Part of the hammer remained. Tenuous granulations were removed from the labyrinth wall. The niche of the oval window was exposed. No stapes. Ballance plastic.

On December 21st the entire wound was reopened and skin grafts were introduced. These have taken. The ear became dry after six weeks, but the hearing was not improved.

CASE 8.—Chronic purulent otitis, caries, and cholesteatoma.

H. G., seventeen years old. Right-sided otorrhœa for ten years, occasional supraorbital headache, and nausea. Profuse, fœtid discharge, $H = \frac{1}{8}$.

Mt shows granulations in the middle ear.

Operation, January 17, 1902. With burr; sclerosed mastoid. Outer attic wall removed, incus and hammer released, hammer had lost its head, incus had no vertical process. The antrum showed a small cavity with some cancellous tissue on the inner wall posterior to the semicircular canal. No fistula. Cavity filled with granulations and cholesteatoma.

On February 3d the wound was reopened, granulations curetted, and skin grafts applied. On the second day, owing to a rise of temperature, the wound had to be reopened and the grafts all came away. Subsequent healing has been unusually obstinate and slow. There has been very little tendency to epidermization. On November 6th, healed, though there is occasionally slight moisture at the oval window. $H = \frac{1}{8}$.

CASE 9.—Chronic purulent otitis, caries, stenosis of canal.

T. O'C., seventeen years old. Otorrhœa all his life. Had been operated on in Ireland. Hearing was lost twelve years ago. He had no symptoms except that the ear discharges, and, on account of the stenosis of the canal, radical operation was advised.

Operation, January 22, 1902. A peculiar bony appendage in the upper and outer part of the canal, under cover of which a fistula led into a cavity. The membranous canal was very much thickened and difficult to release. The bony canal is contracted in the centre by a periosteal thickening of the walls. On opening the cortex a large cavity is entered, extending from the antrum outward and into the zygoma. In the depth the external horizontal canal is exposed with a small exostosis. The space external

to the aditus shows a carious opening into the canal. The cavity in the mastoid was filled with granulations. There was no hypotympanic recess or outer attic wall. Granulations were removed from the middle ear. The inner wall was absolutely smooth and bony, without any details. Plastic according to Ballance.

On February 4th the posterior wound was again opened and skin grafts inserted. These skin grafts have all taken, except that there was a slight discharge from the lower part of the tympanic cavity, which ceased on March 4th.

CASE 10.—Chronic purulent otitis, caries with severe symptoms.

M. S., twenty-two years old. Long-standing otorrhœa. *Mt* is complete, except that at the upper and posterior angle there is a granulation which covers a fistula leading into the antrum. $H = \frac{2}{80}$.

Operation, March 6, 1902. Mastoid showed great sclerosis. Enlarged antrum contained granulations with epidermic scales. Up and back the dura is free and covered with granulations. The drum is removed; hammer normal, incus carious, stapes inadvertently removed. Tympanum contained granulations, promontory was white. Koerner's plastic. Immediate skin grafts to spur and promontory wall.

The subsequent course was uneventful. The skin grafts took, and the ear was dry on April 20th. Hearing reduced to $\frac{4}{80}$. When seen again on September 17th, the hearing was only $\frac{1}{80}$.

CASE 11.—Chronic purulent otitis, caries, and cholesteatoma.

C. A., twenty-two years old. Old otorrhœa. This is the girl who had previously been operated on successfully for the right ear, and she had felt perfectly well until recently, when the left ear again began to discharge, with pain, headache, and vomiting.

Mt total defect. Remnants of the hammer are visible in the upper part. $H = \frac{2}{80}$.

Operation, March 12, 1902. Hammer and incus carious; no stapes seen. Caries and granulations in the antrum. The entire wound is smoothed with a burr; Koerner's plastic done and skin grafts on facial ridge. Subsequent healing uneventful. Skin grafts took and ear was dry on June 2, 1902.

CASE 12.—Chronic purulent otitis, symptoms of retention.

B. W., nineteen years old. Otorrhœa of two years' standing. During the last two weeks very severe headache, with cessation of

discharge. The depth of the canal is stenosed, the walls are infiltrated. The granulations at the bottom were exuding pus. Very severe headache. $H = \frac{8}{10}$.

Operation, April 16, 1902. The antrum and middle ear contained granulations and pus; no hammer, incus carious, stapes in place. Promontory wall very white. Koerner's plastic.

Subsequently skin grafts were inserted into the ear through the meatus, under local anæsthesia. These had all taken. The patient then ceased to come, and her subsequent career is not known.

CASE 13.—Chronic purulent otitis with retention symptoms.

S. H., fifteen years old. Left-sided otorrhœa after diphtheria and measles, at the age of seven. Polyp was removed here eight years ago. Two months ago the otorrhœa began again. Now considerable supraorbital pain with nausea. $H = \frac{12}{10}$.

Canal stenosed, granulations and pus at bottom; some mastoid tenderness.

Operation, May 24, 1902. On retracting the auricle the depth of the canal was found to be filled with granulations; outer wall of attic and aditus defective. Enlarged antrum filled with granulations and cholesteatomatous masses. No ossicles. No extension. Plastic. The flap in the concha was turned down.

In the after-treatment the granulations in the middle ear were unusually difficult to control. Healed December 15th. On January 31, 1903, $H = \frac{28}{10} +$.

CASE 14.—Chronic purulent otitis, retention symptoms, with labyrinth fistula.

A. K., twenty-eight years old. Long-standing otorrhœa. Polyp removed five years ago. During past few months, pain; last night vomiting set in, and intense vertigo on raising the head from the pillow.

Mt total defect. Attic and antrum are shut off by a scar-membrane with a small perforation up and back, which is occluded by polypi and granulations. Fœtid pus. Tympanum dry. $H = \frac{28}{10}$. No objective vertigo, no nystagmus. In the hospital the symptoms, except the dull headache, were somewhat relieved.

Operation, May 22, 1902. Sclerosed mastoid, antrum contained pus, cavity was enlarged with granulations and cholesteatomatous masses. Hammer partly remained. A large defect was found in

the anterior half of the external semicircular canal. The lumen was filled with a dark substance. Koerner's plastic. Healing progressed satisfactorily; all symptoms were relieved. Ear was dry September 15th, 1902. $H = \frac{4}{80}$.

CASE 15.—Chronic purulent otitis, acute exacerbation. Stenosis of canal.

H. R., thirty-two years old. Had been operated on elsewhere six years ago; discharge from ear continued. Has recently had severe pain in the ear. The otorrhœa is of twelve years' standing. Total occlusion of the canal in the depth; pain over right half of head. $H = \frac{3}{80}$. Patient complains of tinnitus and vertigo.

Operation, September 20, 1902. Sclerosed mastoid; antrum enlarged, containing fluid with cholesteatomatous particles in suspension. Caries of wall; no fistula; granulations in aditus and tympanum. Hammer present. Koerner plastic.

Subsequent healing uneventful, and the patient was healed December 10, 1902. H somewhat improved, $\frac{3}{80} +$.

CASE 16.—Chronic purulent otitis, caries of the antrum, extradural abscess; meningitis; death.

Reported in these ARCHIVES, vol. xxxi., p. 373.

CASE 17.—Chronic purulent otitis, cholesteatoma, purulent phlebitis; meningitis; death.

Reported in these ARCHIVES, vol. xxxi., p. 369.

CASE 18.—Chronic purulent otitis, cholesteatoma, caries of the labyrinth, cerebellar abscess; meningitis; death.

Reported in these ARCHIVES, vol. xxxi., p. 99.

CASE 19.—Chronic purulent otitis, cholesteatoma, and caries.

S. C., sixteen years old. L. otorrhœa for many years after diphtheria. Fœtid discharge and headache.

Mt defect, up and back granulations and cholesteatomatous masses. $H = \frac{2}{80}$.

Operation, August 15, 1902. Caries of ossicles, aditus, and antrum. Koerner plastic. One week later skin grafts successfully applied through meatus (local anæsthesia). Healed October 10th. $H = \frac{2}{80}$.

CASE 20.—Mastoid fistula, extradural abscess, jugular bulb thrombosis, pyemia.

C. M., nineteen years old. One year ago external otitis, with postauricular abscess. Mastoid opened, but found uninvolved.

Wound did not heal. Canal stenosed. An intercurrent perichondritis required operation.

On May 27, 1902, while at work, he vomited, felt very ill, and had to go to bed. He was brought to the hospital on the following day and could hardly stand up; pulse very weak, headache and nausea.

May 29th. T. 105.6°. P. 130. No labyrinth symptoms.

May 30th, Operation. Antrum and tympanum freely exposed. Granulations removed. Dura over tegmen normal. Sinus exposed. Intervening bone honeycombed with pus; some pus in sigmoid sulcus. Sinus wall thickened. Healthy granulations. The sinus below was normal and soft. Punctured twice; fluid blood. After operation, slight chill.

May 31st. T. 104°. No chill. Some pain in neck and over right eye. Optic discs hazy. Retained food. Soreness in abdomen.

June 1st. During the night slight delirium, pain about root of jugular vein. It was decided to ligate the jugular vein, suspecting a bulb thrombosis. Glands removed. Jugular vein ligated and divided; it seemed perfectly normal. Sinus exposed nearly to bulb, found normal. Lumbar puncture negative. T. 106°.

The patient then proceeded to go through a well-marked pyemic fever of nine weeks' duration, with daily variations in temperature (the greatest daily variation was from 108.8° to 95°), a few chills, metastases in forearms, legs, left hand; deep abscess beneath rectus insertion, just above symphysis, with secondary abscesses in groin, scrotum, and perineum, but no involvement of lungs or intestines. The aural wound was allowed to completely fill up with granulations. Healed September 10th. H = $\frac{1}{80}$. Optic neuritis still present.

CASE 21.—Chronic purulent otitis, caries, acute exacerbation.

D. H., fourteen years old. Otorrhœa. During past week has been very ill, chilly, nausea and headache.

R *Mt* large perforation filled with bleeding granulations. H = $\frac{1}{80}$. No vertigo.

Operation, September 3, 1902. Mastoid vascular, beginning sclerosis. Antrum contained granulations and muco-pus. Posterior wall defective. Granulations in tympanum. Hammer only found. Oval window filled with granulations. Deep posterior tympanic recess; canal very narrow. Koerner plastic. Still under treatment.

CASE 22.—Chronic purulent otitis with cholesteatoma; complete retention; cerebral and labyrinthine symptoms.

McC. R., twenty-one years old, has had right otorrhœa in childhood and her ear has been deaf since that time, but there has been no discharge for at least ten years. Three weeks ago the ear began to ache, soon headache set in, with dizziness, nausea, vomiting. Intense suffering for the last week.

Stat. pres., Dec. 1, 1900. Temp. 101°. P. 108. Patient very weak. Vertigo and staggering. No nystagmus. Swelling of neck below right mastoid tip due to a deep-seated infiltration. No mastoid tenderness. Ear canal completely filled with a dense mass of cholesteatomatous matter which is removed with difficulty. Pent-up in the middle ear is a considerable amount of foetid pus.

Radical operation, Dec. 3d. Mastoid sclerosed; antrum, attic, and tympanum filled with cholesteatoma. No trace of ossicles found. Extensive destruction of bone. Sinus and dura bare; large defect in the floor of the tympanum, plainly exposing the jugular bulb; another defect in the anterior wall of the osseous canal, exposing the maxillary joint. Infiltration along the jugular vein. Panse plastic. Postauricular wound left open.

Healing was uneventful. The cavity was epidermized within three months. The wound was closed by sutures March 6, 1901. The infiltration along the jugular vein subsided very slowly. Last seen January 5, 1903. Ear dry. Hearing improved (about $\frac{1}{16}$).

CASE 23.—Chronic purulent otitis with extradural abscess.

L. M., eight years of age; has had foetid discharge from left ear since early childhood. Cause unknown. Severe headaches on the affected side for the last five weeks, with restlessness and loss of appetite.

Mt.: Large perforation occupying the whole posterior half with granulating edges. Slight sagging of posterior wall. H. = 0.

Operation, Dec. 25, 1900. Mastoid almost completely sclerosed. Attic and antrum filled with pus and discolored granulations. Caries of hammer and incus. Necrosis of tegmen antri. Small extradural abscess between tegmen and dura. Tympanum full of granulations which envelop the plainly visible stapes. Panse plastic; primary suture.

Cavity epidermizes rapidly but epidermization stops short at the labyrinthine wall of the middle ear. Removal of adenoids dimin-

ishes the discharge from the ostium tubæ but a copious flow continues from the round window.

Last seen Jan. 28, 1903. Patient in good health. Discharge from foramen rotundum continues undiminished. Stapes intact. No labyrinthine symptoms. Patient reports at the clinic every week. If symptoms of retention should occur an operation on the labyrinth would be plainly indicated.

CASE 24.—Chronic purulent otitis with caries and cholesteatoma; subperiosteal abscess.

A. M., seven years old. Both ears have been discharging since the boy had scarlet-fever in his fourth year. The right ear began to ache a few weeks ago. At the same time a swelling appeared behind the ear which has increased steadily. The boy grew sicker during the last ten days with headache, vomiting, loss of appetite.

Stat. pres. Jan. 2, 1901. Temp. slightly above normal. Large postauricular abscess on the right side. Abundant discharge of intensely foetid pus. Tympanum full of cholesteatomatous matter. H. = $\frac{1}{8}$.

Operation, Jan. 4th. Incision of large subperiosteal abscess with gangrenous walls. Fistula in mastoid cortex. The whole mastoid process presents a mere shell filled with disintegrated cholesteatoma. Sinus lies exposed for about $\frac{1}{2}$ inch, shows discolored outer wall but normal consistency. No trace of ossicles found. Panse plastic; primary suture.

Epidermization was nearly complete after seven weeks but there was still some mucous discharge from the ostium tubæ. Removal of the adenoids was urged but patient ceased attendance. His general condition was then much improved.

CASE 25.—Secondary operation.

C. J., seventeen years old. A radical operation for chronic purulent otitis with cholesteatoma was done elsewhere three years ago, leaving a permanent postauricular opening. The tympanum had never ceased to discharge in spite of continued, careful, and skilful treatment.

Stat. pres. Relapse of cholesteatoma on inner wall of antrum and on floor of osseous canal. Very deep hypotympanic recess with carious walls.

Secondary operation, Feb. 1, 1901. Osseous canal trimmed down to the level of the tympanic floor.

Subsequent course uneventful. Healing within five months. Last seen January 28, 1903. Ear dry.

CASE 26.—Chronic purulent otitis with symptoms of retention.

F. E., twenty-six years of age. Discharge from right ear since childhood. Lately pain in the ear, headache, and nausea.

Mt perforated above and behind *proc. brev.* with protruding granulations. Old scars on mastoid and neck the cause of which patient does not remember. $H = \frac{1}{8}$. Chronic lymphangitis on the left side of the neck, apparently tubercular.

Radical operation, Feb. 14, 1901. Mastoid sclerosed, extremely hard. Antrum filled with pus and pale granulations. Walls carious. Caries of head of malleus and both processes of the incus. Usual plastic; primary suture.

Wound healed kindly but erysipelas developed after patient had been discharged from the hospital. During the period of fever the granulating walls of the cavity seemed to dry up. No further packing was required and very rapid epidermization took place under the scab. The healing was permanent; the hearing much improved. The tubercular glands on the left side were removed under local anæsthesia. Patient died December 15, 1901, after child-birth.

CASE 27.—Chronic purulent otitis with caries in antrum.

R. R., twenty-two years old, had measles fifteen years ago and discharge from right ear ever since.

Mt: Perforation above short process. Protruding granulations have been removed repeatedly. $H = \frac{1}{8}$. No symptoms except occasional headache and heavy feeling on the right side.

Operation, March 14, 1901. Ossiculectomy through the meatus. As the ossicles were found normal and the antrum filled with granulations a typical Stacke operation was decided upon and performed immediately. Walls of antrum carious. Stacke plastic; primary suture.

Uneventful healing. Rapid epidermization within five weeks. Hearing distinctly improved.

CASE 28.—Secondary operation.

S. W., fifteen years old. A radical operation for chronic purulent otitis sinistra with cholesteatoma and cerebral symptoms was performed three years ago elsewhere. The tympanum had never ceased to discharge in spite of painstaking and persistent treatment through the larger postauricular fistula.

Secondary operation, February 18, 1901. Small cholesteatoma removed from anterior wall of canal. Thick layer of dense granulation tissue scraped off labyrinthine wall of tympanum. Anterior and inferior segment of tympanic ring removed; tubal ostium curetted. Removal of adenoids.

Subsequently the discharge from the tympanum decreased but never ceased entirely. The Eustachian tube is stenosed near the isthmus; it has never been possible to pass the smallest bougie in either direction. The continued suppuration is apparently due to caries of the osseous tube.

CASE 29.—Chronic purulent otitis with cholesteatoma. Acute exacerbation.

M. R., twenty years old, had scarlet fever fifteen years ago. Since then the right ear has discharged offensive matter. More or less severe earache at intervals. A persistent earache began about three weeks ago causing sleeplessness for the last six days. Severe headache, first at times, now continuous. Discharge more copious than ever.

Mt absent as far as can be seen. Tympanum full of granulation tissue; swelling of posterior wall. Cholesteatoma in attic and aditus revealed by use of probe. $H = \frac{1}{8}''$.

Radical operation, March 18, 1901. Mastoid sclerosed, very hard. Disintegrated cholesteatoma and thin pus in the larger antrum. Defect of tegmen antri with exposure of dura. Labyrinthine wall covered with granulation tissue. Small fragments left of head of malleus and body of incus. Panse plastic, primary suture.

Cavity epidermized, March 15, 1901. Labyrinthine wall not epidermized, but dry. Hearing improved.

Last seen January 10, 1903. Ear dry. $H = \frac{2}{8}''$.

CASE 30.—Chronic purulent otitis with cholesteatoma.

J. R., twenty years old, had right otorrhœa as long as she can remember. For over a year she has been suffering from headache on right side and frequent nausea.

Mt shows fistulous opening in upper posterior segment, fringe of granulation tissue on the osseous edge. Moderate discharge of foetid pus. Long continued treatment in dispensary has been of no avail. $H = \frac{2}{8}''$.

Radical operation, March 21, 1901. Mastoid bone sclerosed.

Dura very low, bare. Antrum large, contains cholesteatomatous matter. Caries of incus. Usual plastic, primary suture.

Uneventful healing. Completely epidermized June 1, 1901.

Last seen January 16, 1903. Cavity dry, epidermis smooth and shining throughout. $H = \frac{1}{8}$.

CASE 31.—Chronic purulent otitis with caries.

O'N. Ch., twenty-two. Right otorrhœa since early childhood. Frequent headaches on same side for the last two years. Under treatment for over a year.

Mt total defect, granulation tissue keeps on growing in posterior recess; persistent, slightly foetid discharge from aditus. $H = \frac{2}{60}$.

Radical operation, June 15, 1901. Bone sclerosed throughout. Antrum filled with grayish granulation tissue; walls carious. Remnant of ossicles in attic, embedded in fibrous tissue. No stapes. Oval window closed. Panse plastic, primary suture.

Subsequent healing complicated but hardly delayed by a mild attack of erysipelas. Cavity epidermizes rapidly except the posterior tympanic recess which dries up gradually.—December 15, 1902. Ear has been dry until a week ago, when after an acute coryza a slight discharge was noticed. There is a small crust in the posterior recess with congested, moist mucous membrane underneath. Some inflammation and discharge from ostium tubæ.

January 27, 1903. Ear dry. Hearing not improved.

CASE 32.—Chronic otitis media with caries and cholesteatoma. Severe labyrinth symptoms. Labyrinth fistula.

H. J., twenty-two years old. Continuous right otorrhœa since childhood, occasional slight discharge from left ear. The latter has always been deaf. Hearing of the right ear has been about $\frac{1}{8}$ until recently. Four weeks ago the right ear began to ache severely. A week later patient, who had previously been dizzy at times, had a sudden severe attack of vertigo with nausea and vomiting. Under constant dizziness the gait became staggering, patient not being able to walk alone. He could hardly hear the loudest voice. During the last week he has had severe headaches and has felt feverish or chilly, especially at night.

Status, July 22, 1901. Patient hardly able to stand up from weakness and vertigo. Temperature, 102.5° . Pulse about 100. Tongue coated, dry. Staggering toward left side. Horizontal nystagmus. Foetid discharge from left ear, sagging of posterior

wall. Hearing by air conduction = 0. Bone conduction much diminished, Weber referred to left ear.

Radical operation, July 23, 1901. Bone sclerosed, ivory hard. Antrum packed with cholesteatoma, dura bare. Two distinct fistulous openings in horizontal semicircular canal. No trace of ossicles found. Panse plastic, primary suture.

The severe symptoms subsided gradually after the operation. During the third week a perichondritis set in, which required extensive removal of the infected cartilage. Cavity was epidermized throughout, October 15, 1901. Hearing see below under 33.

CASE 33.—Chronic purulent otitis with cholesteatoma. Labyrinth fistula.

Same patient, right ear.

Mt total defect; cholesteatomatous masses in attic, enveloping the ossicles. Ossiculectomy was performed August 24, 1901. Both ossicles found carious. Discharge from aditus persisted.

Radical operation, September 19, 1901. Mastoid sclerosed. Antrum filled with cholestatoma. Fistula in horizontal semicircular canal. Usual plastic, primary suture.

Very rapid epidermization (in about four weeks). The symptoms of unbalance—vertigo and nystagmus—disappeared gradually and completely. The right ear remained deaf, the hearing on the left improved decidedly. Patient uses "artificial drum" with success.

Last seen January 3, 1903. Patient in excellent health. Both ears perfectly dry. H (right ear) = 0. H (left ear) = $\frac{1}{8}$ ft., with "artificial drum" = $\frac{2}{8}$ ft.

CASE 34.—Secondary Operation.

L. B., six years old. Radical operation on the left ear was performed elsewhere 18 months ago for chronic purulent otitis with extensive caries. Treatment has been uninterrupted but cavity has not healed. Lately the discharge has been more profuse and headaches on the affected side have been more frequent.

Stat. pres. Large permanent postauricular opening. Copious discharge from posterior tympanic recess and from opening of tube. Epidermis-lining of antrum fluctuating. H = 0. No labyrinthine symptoms.

Secondary operation, July 29, 1901. Abundant pus and extensive caries under the fluctuating skin. A fistulous opening is found on inner wall of the antrum—apparently leading into the

vestibule — and is enlarged with burr. Curettage of tympanum. Removal of adenoids.

The cavity epidermizes promptly and the discharge from the ostium tubæ ceases. The discharge from the posterior recess diminishes but does not cease altogether. It seems to come — at least partly — from the round window. Last seen, February 7, 1903. Patient in good health. Discharge from posterior recess very slight.

CASE 35.—Chronic purulent otitis media with symptoms of retention.

B. S., sixteen years old, right otorrhœa since childhood. Has had headache on affected side frequently for over a year, at times very severe. Neither long-continued "conservative" treatment nor the removal of the carious ossicles (September 3, 1901) brought about an improvement. $H = \frac{2}{10}$.

Radical operation, October 24, 1901. Mastoid bone sclerosed. Antrum filled with cholesteatoma-matrix and discolored granulations. Tegmen antri partly destroyed, dura bare and granulating. Panse plastic, primary suture.

Secondary skin-grafting in the third week; epidermization complete, December 5, 1901. Hearing improved.

Last seen, January 17, 1903. Patient in excellent health. Ear dry. $H = \frac{1}{10}$.

CASE 36.—Chronic purulent otitis media with cholesteatoma. Labyrinthine symptoms and fistula.

C. G., fifty-six years old, has had right otorrhœa as long as she can remember. For over a year patient has had attacks of vertigo and persistent nausea. Lately headaches, restlessness, and loss of appetite. Unable to stoop without getting dizzy.

Stat. pres. January 4, 1902: Patient looks sick and worn out. Temperature normal. Nystagmus distinct at times but not constant. Patient is unable to stand up when eyes are closed; has the sensation of falling and staggers toward the affected side. Fœtid discharge from right ear; total defect of *mt*, cholesteatomatous matter in tympanum. $H = 0$.

Radical operation, January 14, 1902. Mastoid bone sclerosed, extremely hard. Antrum filled with disintegrated cholesteatoma. Large carious opening in posterior crus of horizontal semicircular canal is enlarged with burr. No trace of ossicles. Usual plastic and suture. Cavity epidermized by March 1, 1902. Last report, December, 1902. Patient in good health and able to do hard work. Ear has remained dry and given no trouble whatever.

CASE 37.—Chronic purulent otitis media with caries and cholesteatoma. Labyrinth fistula.

L. L., twenty-six years old, right otorrhœa from early childhood. Has been under treatment for nearly a year. Repeatedly symptoms of retention were noticed. Ossicectomy was performed August 10, 1901, and an anchylosis of the carious ossicles was found. The operation was not followed by any improvement. Lately symptoms of an involvement of the labyrinth have become more and more distinct,—dizziness, vertigo, marked horizontal nystagmus whenever the head is turned toward the right or the eyes in the opposite direction.

Radical operation, March 4, 1902. Mastoid bone sclerosed. Sinus very much forward; dura, very low. Cholesteatomatous matter in antrum. Small fistulous opening in horizontal semi-circular canal. Panse plastic and suture.

Uneventful healing, epidermization complete, May 15, 1902. All symptoms have disappeared.

Last seen, January 4, 1903. Ear in perfect condition. H = $\frac{1}{8}$.

CASE 38.—Chronic purulent otitis with labyrinth fistula.

F. F., eighteen years old, had left otorrhœa in childhood. Lately the discharge has not been continuous but periodical in attacks of recurrent exacerbations. Never any previous labyrinth symptoms. The last attack occurred a week ago and was unusually severe from the start. On the second day patient had vertigo, nausea, and vomiting, which symptoms became more distressing every day.

Stat. pres. April 1, 1902. Temperature, normal. No tenderness over mastoid, canal wide. *Mt* very much swollen without any landmarks. Very small perforation in postero-inferior quadrant. H = 0. Marked vertigo, staggering, horizontal nystagmus.

Operation, April 2, 1902. The question whether to do a simple Schwartze operation or a radical operation was left open until the antrum was opened. It was found to be filled with thin pus and cholesteatoma. There was a distinct fistula in the horizontal semi-circular canal. No trace of the ossicles was found—the tympanum being closed by a thick membrane and filled with granulation tissue. Panse plastic, primary suture.

The severe labyrinth symptoms disappeared within a month. Epidermization complete, May 20, 1902. H. decidedly improved.

CASE 39.—Chronic purulent otitis with retention.

K. G., eighteen years old, left otorrhœa since childhood ; pain in the ear for several weeks with headache, restlessness and sleeplessness.

Stat. pres. April 1, 1902. Osseous canal completely filled with a large polypus. After its removal abundant pus wells out from above. The improved drainage is followed by noticeable subjective improvement. $H = \frac{2}{8}$.

Radical operation, April 24, 1902. Mastoid sclerosed. Caries and abundant granulations in antrum and attic. No trace of ossicles. Panse plastic, primary suture. Healed June 20, 1902.

Last seen January 28, 1903. Ear dry, $H = \frac{1}{8}$.

CASE 40.—Chronic purulent otitis media with caries and symptoms of retention.

H. F., twenty-two years old. Left otorrhœa as long as patient can remember. Has been suffering from headaches on left side, nausea, dizziness, and fainting spells for over a year.

Mt shows large perforation occupying the posterior half. Marked sagging of the postero-superior wall. Foul discharge. $H = \frac{1}{8}$.

Radical operation, July 15, 1902. Sclerosis of mastoid bone. Antrum full of granulations. Caries of ossicles. Very deep posterior tympanic recess is opened up as much as possible and curetted. Usual plastic, primary suture.

Subsequent healing rapid and uneventful. Completely healed October 15, 1902. Last seen January 15, 1903. Patient is in good health and has no more headaches or fainting spells. Hearing improved to $\frac{1}{8}$.

A STUDY OF THE PATHOLOGY OF THE INTERNAL EAR AND THE AUDITORY NERVE.

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(With appended Plate I. from *Zeitschrift f. Ohrenheilkunde*, Vol. XXXIX., No. 1. Fig. 1. Longitudinal Section of the Auditory Nerve in Case 1. Fig. 2. Section through Cochlear Turn in Case 2.)

ANATOMICAL investigations of diseased labyrinths have heretofore been reported in a very limited number, and in most instances only macroscopic relations have been described. This is due in part to the complicated method required to prepare the parts for microscopic section. In the last few years I have had opportunity to examine quite a number of diseased labyrinths and auditory nerves, most of them, however, only from an anatomical standpoint. It was possible in but few of the cases to make the accurate clinical investigations necessary to study disease of the inner ear. But even with vague clinical data the cases offer many points of interest. The two cases selected for this report have, anatomically, little in common. I have been influenced to report them together because in both the ear affection occurred during grave constitutional disturbances, tuberculosis in one and syphilis in the other, because in both cases the ear involvement was bilateral, and because in both the sound-perceiving apparatus only was involved, the conducting apparatus remaining intact.

CASE I.—Multiple disseminated gray degeneration of the auditory nerves.

Both petrous bones of a man forty-three years old, who had succumbed to pulmonary tuberculosis, and who during his illness had suddenly lost his hearing, were submitted to me for examination. They were accompanied by the history that examination of

the auditory apparatus during life failed to reveal pathological lesions. After fixing the specimens in Mueller's fluid and exposing the inner ear, no lesions could be detected. Microscopic sections of the drum-membranes, tympanic walls, and labyrinths disclosed no pathological conditions. Corti's organ and the nerve terminations in the labyrinth and cochlea of both specimens were also normal. However, upon examination of the trunks of the auditory nerves, even with the ordinary double stain of hematoxylin and eosin, a large number of minute pale areas were noticeable between the fibres of the nerve trunks. Most of them were elongated, while some were round and others stellate. The largest of these could be detected with the aid of a simple convex lens. Microscopically, two kinds of tissue were noticeable making up these bodies: a fibrous structure constituting the greatest portion of them, and small spheroidal lamellated bodies, easily recognizable as corpora amylacea. The fibrillar stroma was, with high magnification, seen to consist of fibres of various thickness, arranged in an exceedingly delicate network. The tissue was devoid of cells. These peculiar areas were all situated inside the nerve fibres, although a direct connection of their stroma with the neurilemma could not be traced. Subjected to the Van Gieson stain the fibres took on the garnet red characteristic of fibrous connective tissue. With Weigert's method they took on a bright yellow color, in sharp contrast to the surrounding nerve structure, which had stained the characteristic bluish black (see Fig. 1). Thus the absence of nerve tissue in these disseminated areas was conclusively proven. Although this new tissue was plentiful, it nowhere extended the entire breadth of the nerve trunks. Normal nerve fibres could always be seen between areas of this structure.

The features of interest in this case are the sudden deafness coming on during pulmonary tuberculosis and the peculiar pathological changes in the trunks of both auditory nerves with normal conditions of the nerve terminations and the entire internal ear. It was difficult to determine with positiveness the nature of the pathological lesions. They contained no cells or areas of degeneration to indicate a tubercular process. The absence of nerve structure in their make-up was recognizable and was corroborated by Weigert's stain. The only condition to which they bore resemblance

is that found in the areas of gray degeneration seen in tabes, multiple sclerosis, and other similar affections. This led me to consider these as multiple areas of gray degeneration. The degeneration was so extensive in both auditory nerves that the deafness could well be accounted for by an interruption of the conducting elements.

Steinbrügge¹ has pointed out the difficulty of applying Weigert's method to parts in which decalcifying fluids have to be employed. Why my specimens reacted so successfully to the stain, notwithstanding the use of ten-per-cent. nitric acid for decalcifying, I am unable to explain. The objectionable action of the acids used in decalcifying may account in part for the fact that multiple gray degeneration of the auditory nerve has hitherto been overlooked.

Although in searching the literature I have been able to find a number of cases in which pathological changes of the auditory nerves have been observed, I was unable to find one in which the changes were like those just reported. They resembled those of my case most in cases of ordinary atrophy in which degenerative changes were also present. Such cases have been reported by Politzer,² Habermann,³ and others. It is of interest to note that in these cases the changes in the nerve were not primary, as in my case, but were secondary to traumatism, pressure from tumors or aneurysms of the basilar artery, encephalitis, or tabes dorsalis. They were always associated with loss of structure. Politzer, in the description of his case, compared the atrophic area to a delicate strand of connective tissue, while Habermann spoke of an entire absence of nerve structure. In my case the nerve was entire, but was marked by numerous areas in which the nerve structure was replaced by a finely fibrillar connective tissue, on the interior of which small corpora amylacea were noticeable. This tissue had no similarity with the inflammatory connective tissue seen in neuritis accompanying suppuration of the middle ear. The case of Politzer resembles mine in that the pathological changes were limited to the nerve trunk, whereas the atrophy in most of the cases recorded was noticed mostly at the termination of the nerve in the cochlea.

CASE 2.—Disease of the labyrinths and the auditory nerves in a syphilitic subject.

A man thirty-five years old, with history of a syphilitic infection, and who had been under treatment for "nervous deafness" for about a year, died suddenly upon the street. At the autopsy all of the exposed intracranial arteries were found studded with numerous small (2-5 mm), white elevations. The basilar artery presented an aneurysm about as large as a pea, which had ruptured on one side. The entire base of the brain was covered with clotted blood. Gummata were found in both epididymi, and evidences of inflammation in the testicles. The entire auditory apparatus to the naked eye appeared normal. Microscopic examination of the left petrous bone revealed no pathological changes in the tympanum or drum membrane, while in the internal ear rather extensive pathological changes had taken place. Finely granular deposits were noticeable, covering the epithelium of the roof of the scala vestibuli and the under surface of the lamina spiralis ossea, and basilar membrane in the scala tympani. The deposits contained no cells. They readily took the eosin stain. The most marked and peculiar changes had taken place in the scala tympani, close to the modiolus. Bands of new tissue could be seen extending from the periosteum into the lumen of the scala. The new formation was made up of fibres arranged in a coarse network containing stellate connective tissue corpuscles at their intersections. Where these deposits were most extensive, about one tenth of the lumen of the scala was encroached upon. The cells of Corti's organ were swollen, some containing beads of hyaline material. The vestibule and semicircular canals contained numerous small hyaline, highly reflective bodies in the space occupied by the perilymph. Some of these were spheroidal, others elongated, and some flattened. A few connective-tissue strands similar to those found in the cochlea were also found in the space between the osseous and membranous semicircular canals. Evidence of pathological disturbance was also found in the auditory nerve. Where the nerve entered the labyrinth the fibres were separated by an interposition of round cells and blood corpuscles. At the porus acusticus internus the nerve was so distended that it completely filled the canal. It had been so invaded by cells that the fibres on section appeared very much scattered. More centrally the nerve trunk contained no blood cells but numerous small areas of round cells. They were situ-

ated mainly between the fibres as elongated masses, but several large oval masses, resembling nodes of adenoid tissue, were present. A similar infiltration by round cells was also observed in the branches of the auditory nerve in the labyrinth and in the ganglion spirale.

The conditions in the right petrous bone were very similar to those just described, differing only in being more extensive, especially in the cochlea. The middle ear was normal. The entire scala tympani, particularly at the base in the first turn, was filled with a fibrillar network of connective tissue (Fig. 2). In the interior of the tissue the spaces between the fibres were so small that they were hardly perceptible, while near the periphery the meshwork was coarser. The fibres making up the meshwork were extremely delicate, only a few of the larger ones conveying small blood vessels. Stellate connective-tissue corpuscles, situated at the crossings of the fibres, were scattered about in the tissue. The interfibrillar spaces were filled with a finely granular coagulated mass, which contained a few nucleated round cells. A similar granular deposit was also present in the upper part of the scala-media. Corti's organ was easily recognizable, though some of its cells had undergone hyaline degeneration. In the last turn of the cochlea the periosteum, instead of being lined with the normal single layer of epithelial cells, was covered by six to ten layers. The cells were irregularly and loosely arranged and were nowhere united. They appeared swollen, shapeless, and some of them very granular. Toward the interior of the scalæ they had lost their nuclei and were entirely granular. They had, in fact, lost their identity as cells, and only a granular mass, coalescing with the cellular zone, was recognizable. Changes very similar to the ones described had also taken place in the vestibule. Nodular hyaline masses had been deposited on the interior of the membranous semicircular canals. In the ganglion spirale of the first turn of the cochlea there was an extravasation of blood. The auditory nerve showed the same histological alternation as the left nerve, though less extensive.

The pathological changes of the two ears differed practically only in degree. The sound-conducting apparatus on both sides was normal, almost the entire sound-perceiving apparatus being diseased. The changes were easily recognizable and consisted of the formation of a connective-tissue

network with a few stellate cells. The structure in no way resembled granulation tissue, although it was evidently a product of chronic inflammation, hence the diagnosis of this case as "chronic internal periostitis of the labyrinth." Changes very similar to the above had also taken place in the perilymphatic space of the vestibule. In the auditory nerve the marked infiltration by round cells indicated a chronic inflammatory process of that structure. The cells were abundant between the fibres, having grouped themselves about the blood-vessels. Clusters of cells like the larger ones referred to are usually spoken of as lymphomata.

The question whether these various pathological conditions, directly the result of a chronic inflammatory process, were caused by the constitutional disease, can be determined only by comparing them with other syphilitic conditions. It is known that periosteal inflammation affecting any of the bones of the skeleton is a characteristic accompaniment of constitutional syphilis. It is particularly common in the tibia and the ribs. The formation of circumscribed lymphomata is also a very common occurrence, especially in the liver. There can then be little doubt of the specific nature of the lesions of the labyrinths and auditory nerves in our case. Although ossification, which is common in the advanced stages of syphilis, had not taken place, the disturbance of the auditory apparatus can be construed as a tertiary syphilitic process. It is true that periostitis and neuritis could arise independent of syphilis, yet there was in the described case no evidence of extension of the inflammation either from the middle ear or the meninges. Idiopathic inflammation of the labyrinth has never been observed.

According to Habermann⁴ very little reliable work has been done in the microscopic study of the labyrinth of syphilitics. In most of the cases recorded only a macroscopic report was made, and none of them presented features characteristic of syphilis. Moos⁵ reported a case of a syphilitic who had lost his hearing, in which the external and middle ears were normal but the internal ear had undergone extensive changes. The connective tissue between the membranous and osseous vestibule was hyperplastic and infiltrated with small, round, nucleated cells. The membranous

vestibule itself, the periosteum of the lamina spiralis ossea, and the different portions of the lamina spiralis membranacea were also hyperplastic and infiltrated with cells. Moos and Steinbrügge⁶ described periosteal inflammatory changes in inherited syphilis, but their case was complicated by the existence of an old suppurative middle-ear inflammation. Politzer⁷ speaks of periosteal bone formation in the labyrinth in advanced cases of chronic labyrinth inflammation of syphilitics. The absence of such formation in our case can probably be attributed to the newness of the process.

The subject of syphilitic disease of the labyrinth has also been studied by Gradenigo⁸ and by Steinbrügge,⁹ who reviewed the literature on the subject. Not a case was recorded in which the anatomical changes resembled those of our case in the least which were characterized by connective-tissue formation in the labyrinth and cell infiltration and the formation of lymphomata in the nerves. As all of the neighboring parts, the tympanum, bones, and meninges, were intact and showed no evidence of syphilitic involvement, the process had evidently not reached the parts by an extension but they were primarily involved. A clinical point of interest in connection with this case is that the deafness on one side was only partial. It had been diagnosed as "nervous deafness."

Both of my cases were characterized by an involvement solely of the sound-perceiving apparatus. Both accompanied a constitutional affection. Anatomically, a vastly different condition had developed. In the first of the two cases the anatomical changes in the inner ear in no way resembled other tubercular processes, and it is questionable whether they could be considered tubercular. In the second case the changes were characteristic of syphilis, and the affection could almost with certainty be regarded as specific.

¹ *Handbuch d. path. Anat.*, p. 122.

² *Lehrbuch*, 3d edition, p. 550.

³ *Pathol. Anatomie*, in Schwartz's *Handbuch*.

⁴ *Luetische Erkrankungen des Gehörorgans*, Haug's *Vorträge*, No. 9.

⁵ *Virchow's Archiv*, vol. lxi., p. 313.

⁶ *Zeitschrift für Ohrenheilkunde*, vol. xiv., p. 200.

⁷ *Lehrbuch*, 3d edition, p. 546.

⁸ *Arch. f. Ohrenheilkunde*, vol. xxv., pp. 46, 237.

⁹ *Orth's Handbuch*.

THE USUAL METHODS OF TREATMENT AND OPERATION IN THE EAR AND THROAT CLINIC AT ROSTOCK.

BY PROFESSOR O. KOERNER

Translated by Dr. ARNOLD KNAPP.

AS the views on the most practical method of treatment and operation in certain fields of otology, rhinology, and laryngology still diverge, communications on this subject from various clinics may serve some purpose.

It is my intention to publish a series of papers on the treatment which we have found best in our clinic, especially in regard to those points which are still undecided. We have endeavored to simplify our methods as much as possible and to employ as few instruments as we can, recollecting that our treatment not only consists in overcoming the local trouble, but as much as possible to improve the general health of the patient.

I.—PREVENTION OF INFECTION IN THE TREATMENT OF DISEASES OF THE EAR, NOSE, AND THROAT.

In the treatment of these diseases extreme cleanliness is often neglected under the plea that the processes are necessarily septic and that our aseptic endeavors would be useless and attempts at antisepsis would be futile, on account of the inaccessibility of certain parts of the ear and nose. This does not however relieve us from exercising the greatest cleanliness as we frequently have to treat non-purulent affections.

In order to keep a room clean it is very necessary that

broad daylight have access to all corners. In our clinic we have only one dark room; this is used for the transillumination of the accessory nasal cavities. The custom of treating the ear, nose, and throat in dark rooms has been entirely abandoned by us and we are perfectly satisfied with the examination in broad daylight by the aid of strong electric lights.

The out-door patients department is entirely separate from the hospital rooms. The dispensary has a separate entrance. Work in the dispensary and in the hospital is done at different times of the day. It is evident that major operations should not be done in the dispensary in the presence of patients with purulent affections who bring in dirt and dust from the street.

The operating-room is arranged as in any well equipped surgical clinic.

The preparation of the patient for operation is of some importance. If we are going to operate on the temporal bone we are never sure how far beyond this bone we need to operate. It may be necessary to follow a purulent process deep in the occipital bone or within the cranial cavity, to expose a gravitation abscess in the neck, or ligate the jugular vein—consequently the cleansing and sterilizing must not be limited to the mastoid process.

It is generally customary to shave the hair only in the immediate neighborhood of the ear. The adjoining hair then frequently becomes loosened during the operation and invades the field of operation. This is especially true with the short hair on the temple of women. If then the operation has to be extended we again have to shave and to clean and the danger of infection is present. It is the general practice that in men all the hair of the head be cut short but this is not carried out in women. In the after-treatment, which sometimes takes months, the hair is then liable to become infected with pus and in the packing of the wound it is often carried into the wound, the healing process is retarded, the wound edges become inflamed, and there is eczema in the surrounding parts, infection with the pyocyaneus or erysipelas. This can all be avoided if we cut the hair short.

The changes of dressings are made in a special room. After the removal of the old dressing and cleansing of the surrounding parts with benzine the head of the patient is wrapped in a sterile towel which has a central opening through which the ear and the wound appear. The sterile dressings are only handled with sterile instruments.

Small operations like the removal of adenoid vegetations should not be performed in the dispensary rooms. It is well known that infections frequently follow this operation. Usually 48 hours after the operation, sometimes later, rarely earlier, the temperature rapidly rises and after 6 to 12 hours deposits are found on the faucial tonsils or on the salpingopharyngeal folds, a complication which is usually without danger but very unpleasant and may be followed by a severe otitis media, or infect a relative of the patient or the physician himself. As the period of time between the operation and the onset of the angina is always the same, it is evident that the infection is caused or favored by the removal of the pharyngeal tonsil. The non-operative anginas also begin in the pharyngeal tonsil. If we examine these patients early with the post-rhinoscopic method, we will nearly always find deposits on the pharyngeal tonsil even before they appear on the faucial tonsils. The pharyngeal tonsil may therefore be regarded as the site of infection. We know that the relapsing so-called habitual anginas frequently disappear entirely on the removal of the pharyngeal tonsil, while if the palatal tonsils alone are removed, they recur as before and deposits form on the stump of the previous tonsil.

The anginas after removal of the pharyngeal tonsil have become very much rarer with us since we performed the operation in a special room. I should like to add that an angina of this character may follow the digital examination of the naso-pharynx; we consequently now always examine with a protected finger.

For the sake of completeness in this discussion on surgical anginas, I should like to state that they may occur after operations on the nose. The site of infection in these cases is the lymphatic tissue in the nasal mucous membrane. The removal of the pharyngeal tonsil in a special room is

also desirable to prevent the possibility of infection with scarlet fever which not rarely follows from a wound in this region.

It is well known that a surgical scarlet fever exists which sets in after operations in the most varying parts of the body and usually runs its course without producing the customary angina. This is explained by the fact that the entrance for the scarlet fever poison in the ordinary non-surgical scarlet fever is found in the lymphatic ring which presents distinct pathological changes. If any operative wound furnishes the site of entrance for the scarlet fever germ, the scarlet fever angina is absent. Hence scarlet fever after the removal of adenoids is a particular form of surgical scarlet fever, as the site of entrance is in the same location as in ordinary scarlet fever. Consequently in these cases the angina is also present but it differs from the former disease inasmuch as the period of incubation is shorter and more uniform (2 days).

Many minor operations have to be performed in the dispensary rooms. How can we best avoid infection of the wound in these cases? It is well known that infectious germs are not transmitted by the air but usually by the instruments, bandages, or hands. We must therefore only employ instruments which have been boiled, dressings which have been sterilized, and touch the wound as little as possible with our fingers.

It is just as well to keep the air in the dispensary as pure as possible. Our dispensary is arranged like an operating-room. The walls are painted, the floors are of mosaic. They are washed every day. There are numerous wash basins with cold and hot water. Patients with severe infections, especially with erysipelas, are excluded from this room. We endeavor to keep the clinic as free from the pus as possible of all acute and profuse chronic otorrhœas. The canal is drained with a strip of gauze and an ear dressing is applied. On changing the dressing the gauze and cotton is immediately placed in a porcelain pail. The well-known black ear patch is not allowed.

The aural suppurations in the hospital are treated in the

same manner so that the pillows, floors, and tables are not infected with the purulent dressing.

It is especially important to keep the hair away from the wound. This is especially true in the treatment of furuncle of the auditory canal in which these hairs often furnish a constant source for relapses. All instruments should be boiled, even the olive tips of the auscultation tubes and pharyngeal mirrors. A mirror which does not stand boiling should be returned to the maker. All instruments after use are placed in a porcelain dish, the nurse collects these dishes, and the instruments are boiled and returned to their places. Our syringes are fitted with metal pistons. As an irrigating fluid we use a mixture of hot and cold water without the addition of any disinfectant. Gauze and cotton are always at hand in a sterilized condition. The cotton is wound around the ends of thin pieces of wood which are thrown away after use. They are collected in small test-tubes in which they are sterilized. The gauze strips have a selvedge and are in rolls.

To grasp the tongue in examining the larynx we use gauze handkerchiefs. We endeavor to instruct our patients in the exercise of cleanliness; gauze and cotton must not be removed from the ear by the patients.

The most common pathogenic microbe is the staphylococcus albus. This organism is of special importance to us as it causes a secondary infection by which acute suppurations become chronic. If our precautions are efficient, the acute middle-ear diseases usually heal promptly. The bacillus pyocyaneus is also an excellent control of our precautions as it is ubiquitous and can be cultivated in any axilla under moist dressings. The pyocyaneus is not the ordinary saprophyte but is sometimes pathogenic in ear diseases. It can produce an acute otitis media and seems to cause the dreaded perichondritis after the plastic step in the radical operation. This is according to the observations of Brieger and Leutert and in the four cases of perichondritis which I have observed in the last twelve years this organism has been present.

The acute pyocyaneus otitis is characterized by a bloody

serous exudate in the tympanum and the simultaneous presence of vesicles in the canal. If the operative wound be infected by the pyocyaneus, the margins become red, the temperature rises, and erysipelas is suspected. On the following day the character of the infection becomes manifest by the greenish discoloration of the gauze. The redness and fever disappear in a few days but the pus retains its green color. I have found packing and dressings impregnated with a 2 to 5 % silver nitrate solution to be most efficacious against this infection.

Finally a few words on the protection of the physician against infection.

The patients suffering with laryngeal phthisis are the most dangerous as during examinations and treatment they exhale and cough up a spray of fluid containing bacilli. We protect ourselves by carrying a square handkerchief over the nose and mouth held at the upper corners by means of tapes, weighted with lead bullets which are suspended over the ears.

AFTER-TREATMENT OF RADICAL OPERATIONS WITHOUT PACKING.

By DR. A. VON ZUR MUEHLEN, RIGA.

IN recent years I have modified the after-treatment of the radical operations; in certain cases I leave out the packing after the first or second dressing. The advantage of this should not be underestimated. The procedure of packing is often painful and difficult, especially in children, and the after-treatment without packing in a certain number of cases seems to have shortened the length of treatment. The depressions and cavities formed at the operation fill in with newly formed tissue; they appear smaller and less deep, and, consequently, are easier to oversee and to keep clean. The anatomical relations of the entire organ may resemble under favorable conditions closely the normal. My procedure after operation, in brief, is as follows:

At operation I endeavor to proceed as conservatively as possible. I remove from the healthy bone only so much as is absolutely necessary to expose the diseased bone, and especially all of the recesses and cells. The new cavity, therefore, is as small as possible, and consequently will be covered with epidermis more quickly. The wisdom of this conservative principle is surely now granted by everybody. At the same time, too great caution may induce certain unpleasant complications, to which I wish to return later on.

I do not wish to enter into a discussion of the various methods of the plastic step of the operation. Pathological conditions found at operations determine which plastic procedure will give the best results. Thus, in some cases I have had very good results by only splitting the posterior

canal wall either to or into the concha. In other cases I have performed the operation according to Panse, Koerner, or Stacke. I have never found it necessary to make use of any of the complicated plastic operations as advised by Passow or others. The retroauricular opening of the wound I always close primarily. The first tampon of iodoform gauze remains, as is usual, for six days. The following tampon, which is introduced very much more loosely, remains for two or three. It seems that eight days are sufficient to fixate the flaps to their new layer. As soon as this is accomplished I leave off the packing. If, during the subsequent course, packing seems desirable, I endeavor to introduce it as loosely as possible, and leave it off very quickly. The wound is dressed every day. The ear is irrigated with warm water, a procedure which I can only recommend. Every one who has had a general surgical experience knows that a granulating surface is unusually advanced or benefited by the warm water bath; the irritating secretions are removed, the newly formed, delicate epithelium is protected from maceration, and is permitted to spread out. Irrigation of the ear replaces the water bath. Of course, irrigation must not be applied too violently. If the patients live far away, I permit them to practise the syringing with due care at home, once or twice a day. I have never seen any harm come from it; in fact, the cavities seem to be always clean and healthy and become rapidly covered with epithelium, without the irritating eczema.

In very foetid discharge, where irrigating alone does not suffice, a 10 % naphthalin solution stood me in good aid, just as naphthalin in general has been recognized as one of the best means of treating unclean wounds. Naphthalin powder is not so good, for it is apt to cake. I like to use the naphthalin oil, especially when a disagreeable foetor is noticeable from the ear, either in acute or chronic cases.

One would think that after leaving off the packing the sprouting of the granulations would proceed unduly. This to a certain extent is true, and is generally due to a remaining diseased condition of the bone; it disappears spontaneously on the elimination of this bone surface. In a

perfectly normal healing, the formation of granulations is a very free one, and may appear exuberant to one who is accustomed to retard each single granulation with a suitable tampon. This fear I do not think is well grounded. If one permits the healing process to go on of itself, then after the formation of a new, solid groundwork epidermization proceeds. If the formation of granulations should, however, become exuberant, especially in the dangerous places (aditus), it is very easy after an anæsthetic (10 % cocaine solution) to remove the excessive formation of granulations with the sharp spoon.

In some cases the bony cavity was filled with new tissue to such an extent that the meatus in the depth appeared to be conically constricted. Notwithstanding, all discharge ceased, the hearing improved, and the subjective symptoms disappeared. The stenosis was caused from the lower more than from the posterior wall, on which a crescentic prominence had been formed. This may possibly have been due to a lesion of the membranous canal, or the facial spur may not have been sufficiently trimmed down.

In no case was there a membranous formation between the middle ear and the cavity existing in the mastoid process. This latter cavity was filled with newly formed tissue, and presented a shallow depression. Though the cessation of the discharge generally presupposes healing of the morbid process, the possibility of reinfection is always present. The ear is in a condition as with a large perforation of the drum.

If, during the after-treatment without packing, a tendency to a formation of stenosis is apparent, then we must use packing; and especially in the cases where there is a tendency for membranes to form between the middle ear and the mastoid cavity.

The hemorrhage after curetting of granulations can be easily controlled by the introduction of the tampon, which remains for one day. I remember only one case where such an excessive formation of granulations occurred in the after-treatment as to be almost uncontrollable.

A boy, of fourteen, suffered from otorrhœa after scarlet fever. Two weeks before his admission facial paralysis developed, pre-

sumably due to retention of pus. The external canal was filled with granulations. At operation an extensive carious process, with cholesteatoma material filling an irregular cavity, was found present. The aditus and middle ear were filled with granulations, and the labyrinthine wall contained some rough surfaces. The sinus was exposed. The middle cranial fossa was not opened. The bone was sclerosed; after the first tampon a croupous-like membrane appeared throughout the wound cavity. A profuse suppuration, with a tendency for the formation of granulations existed. Repeated curettings were without avail; the formation of granulations ceased, the facial paralysis improved. The usual formation of granulations was due to rough bone, which could be felt in the depth of the mastoid wound with the probe.

I hesitated to proceed to the secondary operation until the demarkating process had plenty of time to take place. At the secondary operation the sequestrum was removed. The healing then proceeded with great rapidity, and the patient was quickly dismissed as cured.

Those cases in which caries and suppuration in the antrum indicated the radical operation, presented, after healing, the picture which I have just sketched. If the epidermization is complete, there is above the ridge of the semicircular canal a more or less flat cavity; the middle ear is freely surveyed; the aditus is shallow. The relations of the posterior wall may resemble the normal to such a degree that the results of the operation may sometimes not be detected, especially as in certain cases the middle ear becomes closed off externally by a newly formed membrane.

It does not seem probable to me that the unrestrained formation of granulation tissue can cover over epithelial remnants in the bony cavities and subsequently lead to a relapse in the sense of a form of cholesteatoma.

It seems to me questionable whether it is right in each case to oppose nature's tendency for each organ to more or less resume its normal anatomical and physiological conditions in the process of healing. If, from a chronic inflammatory process, or by operation, the mucous membrane of a cavity about the ear is destroyed, there is really no reason why the new cavity should be preserved in its entire integrity.

I should not have published my results at this time, if I had not been encouraged to do so by the favorable experience which Dr. Voss has had from the same method of treatment. For the last three quarters of a year he has left off packing, on my recommendation, and is very well satisfied with the results, which are mentioned in his article which recently appeared on "Aural Disease in Hysterical Patients" (These ARCHIVES, vol. xxxi., p. 304).

AN ANATOMICAL METHOD OF DEMONSTRATING THE ACCESSORY CAVITIES OF THE NOSE.

BY DR. G. BRUEHL, BERLIN.

I PUBLISHED a new method for demonstrating the accessory sinuses of the nose in the *Anatomischer Anzeiger*, vol. xiv., No. 16, p. 7. This consisted in filling the accessory cavities of a decalcified skull with mercury and the cranial bones were then made transparent. These specimens were fairly successful in regard to the relations of the accessory cavities, but were not quite satisfactory as regards permanence for the injected mercury was very apt to escape and its lustre disappeared after a number of years. I have adopted the following procedure, which has been more satisfactory:

A fresh or alcohol skull is macerated one quarter; the soft parts are dissected off and it is decalcified in a ten-per-cent. nitric acid solution. Decalcification takes longest at the glabella of the frontal bone and the zygomatic process, but is complete in two or three weeks. After washing in running water, the skull is hardened in alcohol, then dehydrated, and finally subjected to a mixture of equal parts of absolute alcohol and ether. The specimen is then placed in carbol-xylol. On the following day, if the bone has been dehydrated and decalcified, it is cleared. The specimen is removed from the carbol-xylol, the excess fluid is allowed to run off, and an opening is cut in the septum of the frontal sinus; its nasal canal is closed off with cotton. Wood's metal is melted in a spoon with a tapering tip. Care must be taken not to heat it too much; just enough to melt it is

the best. It is then poured into the frontal sinus with the specimen held on its side. The sphenoidal and ethmoidal sinuses are then filled. The maxillary antrum is filled from an opening in the canine fossa. The amount of fluid necessary to fill the cavity enables us to determine its cubical contents. In order to improve these specimens for demonstrating purposes, after the metal has become hard, windows may be cut into the walls of the accessory cavities. Enlarged blood-vessels appear through the bone. The furrows in the bone for the vessels may be outlined with water color. All the individual features of these cavities are thus capable of being demonstrated. Their position to the cranial cavity, to the mouth, to the nasal cavities, and their relation to one another, are exactly given. They should serve as a valuable addition to the corrosion anatomy of the nose.

THE CONTAGIOUSNESS OF ACUTE OTITIS MEDIA.

BY DR. L. WOLFF, FRANKFURT-AM-MAIN, GERMANY.

AT the second meeting of the German Otological Society in 1893, I reported on the simultaneous appearance of severe middle-ear disease in three brothers and sisters, and concluded as follows: "The most interesting point in this communication is the question of the etiology. It is very striking, that of four sisters and brothers who were all taken sick with catarrhal symptoms, three should suffer from simultaneously appearing purulent middle-ear disease and two of these were ill for some weeks with very severe aural symptoms. Everybody is surely of the opinion that there was a common infectious agent."

Not only the onset, but the course of the disease and also the variety of the middle-ear infection, presupposed influenza, though the pathological bacillus was not determined.

Since the observation of these cases I have had numerous opportunities to observe the simultaneous appearance of acute middle-ear disease in members of the same family. The last observation was that of three boys. The oldest of these, following a severe cold (influenza?), suffered from a double otitis with high fever. One week later another brother began to suffer from a double otitis with severe symptoms, and on the next day, the youngest brother was taken ill with the same affection. After paracentesis, all three children recovered completely in the course of a number of weeks.

Our well-known colleague, Marcel Lermoyez, has been very much struck by this grouping of acute middle-ear

disease in members of a family who live together. Though we regard this peculiar onset as the result of common infection, Lermoyez, in a paper entitled "*La contagion des otites moyennes aiguës*," cites seven cases and concludes that acute otitis media is contagious, and demands that the patients be isolated.

If we examine the cases which he gives — each case corresponds to two case histories; one, of the one first affected, and the other, of the one secondarily infected — we find that Lermoyez mentions as the etiology of the middle-ear inflammation in two cases, influenza; in one, angina; and in one, measles. In three cases, the acute otitis media developed without a preceding illness. It will be noted that in four of the cases described, the disease was typically infectious. If we acknowledge a similar infection for both patients, the complication with otitis is then readily explained — especially if we remember how very frequently the ear is attacked in all infectious diseases. Why should we, therefore, and what right have we to say that an ear disease is transmitted from one patient to another?

Lermoyez then cites three further cases where the ear disease of the secondarily affected person was preceded by no other illness, and he thinks that the otitis was transmitted as such — disregarding the fact that in one of the cases the patients were children suffering with catarrhal nasal troubles, and that thereby a suitable condition for a middle-ear affection was present. In the other three cases, the variety of the middle-ear disease is one which we usually consider as characteristic for influenza. Thus, in Case 5 Lermoyez speaks of an hemorrhagic myringitis and in the corresponding case of an enormous bloody bulla. The same existed in Case 7, and in the corresponding case the otitis was a typical hemorrhagic one. Does it not seem most likely that the secondarily affected patient also suffered from infection with influenza? Influenza, unquestionably, can be transmitted, and the contagiousness of the affection is probably doubted by few at the present day. Finally, in regard to the first case, of the woman whose husband had an otitis following influenza, and she was subsequently taken

ill with otitis, it is most likely that her otitis was the result of an influenza infection. But in this case, and in the two previously mentioned, no symptoms of an affection preceding the otitis, not even of infection, are said to have been present. Nevertheless, assumption that the otitis was transmitted as such does not seem warranted. In times of epidemics, cases of typical infection are not uncommon where the otitis begins without any other symptom of an infectious attack, although it is probably nothing more than a secondary infection.

Lermoyez regards the similarity of the form of middle-ear disease in the various double cases as a proof of their contagiousness. Finally, this author sees a support for his view in the fact that the occurrence of secondary otitides in the hospital is much more frequent than in private practice. He thinks this is due to the close contact and surroundings of hospital patients. But, surely, is it not more likely that it is because hospital patients are of an entirely different class of the population, and is not this class of the population the most liable to affections of the naso-pharynx and the ears?

In conclusion, it seems to me that in the above cases the aural inflammations were the result of infectious diseases, and that they are secondary in nature and originate from a common primary cause. The latter, of course, like every infectious disease, can be transmitted from one individual to another. But that acute otitis is in itself contagious, and necessitates the isolation of patients, does not seem to me to have been proven.

THE OCCURRENCE OF RHODAN IN THE NASAL SECRETION, AND ITS ABSENCE IN OZENA.

BY DR. MUCK, ROSTOCK, GERMANY.

I HAVE recently demonstrated that rhodan (potassium or sodium) forms a normal constituent of the nasal secretion, and that it is derived principally from the serous glands. Moreover, the catarrhal thin fluid secretion is as rich in rhodan as the sero-purulent.

One sometimes is able to obtain a very distinct ferric chloride and iodine acid-reaction, if we touch the pockets of the nose with our reagent paper. The accumulation of salt at this location and at the introitus in general is because the nasal secretion in passing dries up in this region; and in drying, the salts are here precipitated.

If, in the presence of chronic catarrhal inflammations of the nasal mucosa the serous exudate becomes greater than the mucous, then the rhodan test is unusually striking. Hoppe-Seyler found that the quantity of anorganic salts in a state of serous exudation increased from $\frac{1}{3}$ to 1%.

The continuous discharge of a large amount of thin, fluid, nasal secretion is a symptom of nasal hydrorrhea. This fluid can be nasal or cerebro-spinal in origin. It has been demonstrated that the fluid in nasal hydrorrhea in general corresponds to the composition of the cerebro-spinal-fluid, and this has frequently given rise to the idea that this hydrorrhea is a flowing off of the brain water, through the nose. Cases of this kind are known. Cerebro-spinal fluid does not contain rhodan; consequently, in doubtful cases the origin of fluid dropping from the nose may be determined by the rhodan reaction.

The amount of rhodan contained in nasal secretion is individually different, just as the amount of rhodan in the saliva varies. In general, whenever the saliva is unusually rich in rhodan a very distinct rhodan reaction appears in the nasal secretion. The opposite holds true in the absence of rhodan in saliva.

I examined twenty cases of genuine ozena, for the presence of rhodan. I regard under the picture of genuine ozena, cases of chronic rhinitis with atrophic processes, especially of the lower turbinal and with the formation of crusts and fœtid pus which does not appear to come from any of the accessory cavities. The result of the examination was, that in the secretion of ozena-patients no rhodan was present. In one case, a very weak reaction was found. The fluid contained in Gottstein's packing gave no reaction. These results correspond to the histological condition of the atrophic nasal mucosa in which the glandular cells have atrophied. Fatty degeneration of all glandular epithelium is the most constant condition present in ozena; consequently, the serous secretion is diminished in quantity and its constituent parts must decrease. I cannot say whether the fetor in ozena can be traced at all to the absence of rhodan.

ENTOTIC MURMUR DUE TO ANEURYSM OF THE OCCIPITAL ARTERY.

BY DR. MUCK, ROSTOCK, GERMANY.

The patient, C. W., 68 years old, fell eight years ago from a ladder, striking the back of her head. She became unconscious and vomited. No results followed this injury until the middle of this year when she became conscious of a continuous pulsatile beating in her ear, which later became so intense as to disturb her sleep and interfere with her general health. On the 23d of September she visited the clinic for relief.

On admission a healthy woman presented a lobular, pulsating tumor, situated under the skin, beginning at the posterior margin of the mastoid process and extending backward to within 2 or 3 *cm* of the occipital protuberance. The vertical diameter of the tumor was the same as the one just mentioned. The pulsation was uniform, most marked at the anterior lower corner, corresponding to the place where the occipital artery becomes superficial. Pressure exerted at this point prevents pulsation in the entire tumor. At the posterior margin of the tumor, there is a linear cicatrix about 2 *cm* long. *Mt* and hearing normal on both sides.

It was decided to operate, to relieve the patient of this very unpleasant murmur. The dissection of the aneurysmal sac was somewhat difficult, as it was found to communicate with a number of small arteries. The healing of the wound, retarded somewhat by an attack of erysipelas, was complete in the middle of October.

The effect of the operation was not brilliant, inasmuch as the pulsation could still be felt in an area of 2 *cm* in diameter. The subjective aural symptoms had, however, completely disappeared.

Disturbing entotic murmurs produced by pathological dilatation of the blood-vessels about the ear have been frequently described. We have, however, not been able to find a case where these auditory sensations were the result of aneurysm of the occipital artery.

THE MASTO-SQUAMOSAL SUTURE.

BY DR. ADERMAN, OREBRO, SWEDEN.

THE frequency of a masto-squamosal suture has been previously investigated by Kieselbach and by Kirchner. These two authors, however, did not arrive at the same conclusions, and so I have thought it worth while to study the relations on a larger number of skulls, especially as I had the opportunity of examining the large collection in the Natural History Museum of Vienna.

Kieselbach found, in an examination of 300 skulls, a complete suture on both sides in 15; complete on the left side with a trace on the right, in 8; left complete, right without trace, 5; right complete, left trace, in 4; bilateral trace of the suture, in 20; left trace, right no suture, in 12; right trace, left no suture, in 6; and finally, in 76.9 % of these 300 skulls, neither a suture nor a trace was present on either side.

Kirchner, in his 174 skulls, found 6 which presented a complete suture, and of these, 5 were the skulls of children under ten years of age.

My investigations have shown that the presence of this suture is distinctly more frequent. I regard a distinct masto-squamosal suture as present, when it appears like an ordinary suture of the cranial bones, though it may have disappeared at a number of points, as is usually the case at the apex of the mastoid process. If the two bony surfaces were completely divided by a long suture, I have designated this suture as an unusually well developed one. A trace of the suture is one which is represented by small apertures, usually in the middle of the mastoid process, and there are

furrows in the bony surface. The collection of skulls contained skulls of known and skulls of unknown age. I have examined 2554 skulls. Of these 1413 were of unknown age; originating in Austro-Hungary, 724; 241 were brought from the neighboring countries, Italy and Greece; 448 were of various other races; Hindoos, Javanese, Malays, etc. These three groups presented practically no difference. Of the 1413, 219 presented distinct sutures on both sides; in 54 the suture was distinct on one side and on the other, a trace; in 7, a distinct suture on one, while on the other there was no trace. Of the skulls with distinct sutures, 9 were children's skulls and 3 were those of old people; 19 had very well developed sutures on both sides; 180 had traces of sutures on both sides, and 79 only on one; 874 were completely without sutures; of these, 14 were skulls of children. The skulls of determined age were 1141. Of these, 142 had distinct sutures on both sides; 57 were distinct on one side, a trace on the other; 5 distinct on one side, with no trace on the other; very well developed sutures were found present on both sides in 13; 164 had trace on both sides; 73 a trace on only one side; 700 were without trace on either side. Of the skulls with distinct sutures on one or both sides, there were none belonging to children, 5 were those of old people. Among the skulls without sutures there was one child's skull and those of 24 belonged to old people. Of middle age, those without sutures were 33; with distinct sutures, 28. I have examined the skulls of all these various races, and have not been able to find any particular difference as to the frequency of the suture, with the exception of the negro. I have examined 79 negro skulls, and of these there was only one with a bilateral distinct suture. One had a bilateral and one a unilateral trace of suture, and 76 were completely without sutures. There were no children's, or skulls of very old people, in this group; 49 were of definite age; the middle age was 27; the age of the one with the distinct suture was 30.

Finally, of 5138 mastoid processes, 1806 had sutures. Of these, 64 were well-developed, 845 were easily recognizable, and 951 presented traces.

ACUTE MASTOIDITIS COMPLICATED BY SCLERODERMA.

BY DR. M. KAMM, Breslau, Germany.

M. S., seventeen years old, was taken ill in the beginning of October, 1899, with pain in the left ear. Otorrhœa one week later, which soon became less, but pain set in behind the left ear. On October 26th there was a small perforation of the *Mt* in the upper anterior quadrant, through which yellowish pus appeared in moderate quantity. The drum was otherwise reddened, thickened, and bulging. $H = \frac{2}{80}$. Weber to the left; Rinne, left negative.

The patient complained of severe pain in the left mastoid process, and when the head was rotated in the opposite direction. The skin below the mastoid process, down to the clavicle, is thickened and hard. A Bezold mastoiditis was immediately suspected, though this diagnosis was given up after we had examined the other side, where, in the absence of any otitis, the skin of the neck was in the same condition. On further examination, we found that the skin all over the body had this same board-like consistence, except the abdomen, the buttocks, and the lower extremities. The consistency of the abnormal skin was something like that in the frozen cadaver, which cannot be indented with the finger nor be raised in a fold.

There was no question but that we had to deal with a case of diffuse scleroderma, an affection which is rather rare, and of which there are not more than one hundred cases recorded in literature. The patient had no idea of the abnormal condition of her skin, nor did she know anything about the origin.

To explain the pain in the mastoid region, we had to decide between an empyema or a carious process in the bone. As the symptoms of otitis were not severe, we first enlarged the perfora-

tion in the drum downwards and backwards. This was followed by relief of the pain, and the discharge was increased. The improvement was interrupted by the appearance of an infiltrated region of the skin along the posterior margin of the mastoid process; and as the discharge from the ear had continued profuse for more than a month, an operation was decided upon. Incision through the skin gave rise to a marked venous hemorrhage. At the operation, the mastoid contained necrosed bone and granulations; the sinus was exposed, and the antrum contained granulations. Recovery was tedious but progressive, and was not retarded by the scleroderma.

Conclusions.—1. Scleroderma may complicate the diagnosis of mastoiditis, inasmuch as it may simulate an infiltration of the skin. 2. Scleroderma may cause marked venous hemorrhage during the operation. 3. Recovery after operation is not retarded by this condition.

ON THE DUPLICITY OF THE ACCESSORY SINES OF THE NOSE.

BY DR. G. BRUEHL, BERLIN.

Abridged Translation.

THESE observations are based on the study of 70 specimens from my own collection and 130 specimens belonging to Dr. Arthur Hartmann, who kindly placed them at my disposition.

Duplicity of the accessory sinuses exists when two cavities instead of one occupy the frontal, maxillary, or sphenoidal sinuses. The practical importance of this anomaly is evident. If in a duplicated frontal sinus an empyema is diagnosticated, it might occur at operation that a healthy cavity be exposed from the eyebrow and the diseased cavity be situated above. It is possible, in the case of a maxillary empyema, to puncture a healthy cavity if the maxillary antrum be divided into two cavities. A probe introduced in the sphenoidal cavity may enter into an upper cavity of a duplicated sinus while the inferior is the one filled with pus. The rhinoscopic diagnosis of an empyema in these cases is unusually difficult. Though it is of greatest practical importance to determine the presence of a duplicated sinus, the anatomical explanation of this anomaly is most interesting. Macroscopic head sections of macerated or tissue specimens enable the study of these anatomical conditions; the septum of the frontal and sphenoidal sinuses must be removed, and the maxillary antrum opened from the outer wall.

If we examine a skull divided in the middle line, we frequently find two cavities in the frontal bone of about the

same size. The lateral one of these two cavities has an outlet underneath the middle turbinal in the nasal cavity, while the medial cavity has no opening in the nose. If we look at the other half of the skull, we find a cavity corresponding to the median cavity with an outlet underneath the middle turbinal. In other words, we have here a deviation of the septum of the frontal sinus, which is so marked that it almost seems that both frontal sinuses are situated on one side of the frontal bone. In one of my specimens there are two cavities in the right frontal bone separated by a bony septum. There is a round hole in this septum; the outer cavity alone communicates with the nose.

Duplicity of the frontal sinus is simulated when the section passes through the frontal sinus with an oblique septum so that the lumen of the cavity is traversed directly in front of the septum. In this case we find two or three superimposed cavities in the frontal bone, of which the lowest one communicates with the nose. Bony septa are frequently found in the frontal sinus, especially in the lateral prolongation. These septa divide the cavity into deep depressions and angles without closing off isolated spaces. There are no pneumatic cavities in the frontal bone which do not connect with the nose. It is, in fact, this connection with the nose which explains the anatomical peculiarity when several cavities are present in the frontal, sphenoid, or superior maxillary bones. Embryology shows that all pneumatic cavities of the nose originate from the main nasal cavity and at typical situations. The first part of the accessory sinuses formed in normal development is the communication with the nose. Hence, embryologically, it is not possible to conceive of cavities in the frontal, sphenoid, or superior maxillary bones without a communication with the nose. These pneumatic spaces have not all an equal anatomical importance. Merkel's statement, that the accessory cavities of the nose are, embryologically, nothing more than dilated and liberated ethmoid cells, is not accepted at the present day. Steiner and Toldt have regarded the frontal and sphenoidal sinuses as ethmoid cells, which also does not agree with modern views. The ethmoid

cells develop from the dilatation of the interturbinal passages situated between the turbinals; the lining mucous membrane is contained at first in a cartilaginous envelope formed from the primary cartilaginous capsule of the nose. The ethmoid cells in general remain small and do not extend beyond the area of the cartilaginous ethmoid. The cartilage which forms the ethmoid labyrinth disappears together with the primary cartilaginous capsule during embryonal life and becomes transformed into bone before birth, so that the ethmoid labyrinth has arrived at its main growth at birth.

On the other hand, the frontal and the maxillary cavities represent dilated parts of the first main fissure, and the sphenoidal cavity the posterior part of the main nasal cavity (Killian). In foetal life these are represented as small prolongations of the nasal mucous membrane. They do not reach their full development until after birth, when the face skeleton reaches its growth, and are not bound to the limits of the primary nasal capsule and extend deep into the surrounding bones.

According to the investigation of Killian, the middle meatus presents a prolongation externally to the anterior extremity of the middle turbinal, which extends in the direction of the forehead (frontal prolongation). If this extends between the lamella of the frontal bone, the direct variety of the frontal sinus is formed. Occasionally, in adults, instead of the true frontal sinus, a rudimentary prolongation exists. In addition there are frontal sinuses which do not result from the frontal prolongation but indirectly from an ethmoidal cell. Ordinarily in the outer wall of the frontal prolongation there are two or three small fissures from which the frontal ethmoid cells extend into the lateral bony wall; one of these may extend into the frontal bone and become the frontal sinus. The starting-point of this frontal sinus lies in the infundibulum, or, in case this is occluded, in the frontal prolongation. In short, according to Killian, the frontal sinus may develop in one of the following ways: (1) formation of the frontal sinus from a frontal prolongation; (2) formation of the frontal sinus from a frontal cell;

- (3) duplication from frontal prolongation and frontal cell;
- (4) duplication from two frontal cells.

We are justified in speaking of the true duplication of the frontal sinus only in case of a double formation from the frontal prolongation. In the double formation from the frontal prolongation of the frontal cell the larger cavity, the one which communicates with the frontal prolongation, should be regarded as the true sinus, while the smaller, originally formed from the frontal cell, is an ethmoid cell displaced anteriorly (*bulla frontalis*). Occasionally two frontal cells extend into the frontal sinus somewhat occluding the lumen. Of 200 specimens two cavities were present in the frontal bone of 28. Zuckerkandl found a *bulla frontalis* present in 6 out of 30 specimens. The small cavity which is pushed into the true frontal cavity is either represented by a prominence of the posterior wall of the frontal sinus or it may be so well developed that it bulges upward into the sinus, approaches the wall, or becomes united to it. Occasionally it is as large as the true frontal sinus.

In regarding the ethmoid as built up from its main lamellæ we see that the lowest ethmoid lamella is represented by the uncinatè process, the second by the *bulla ethmoidalis*, the third from the base of the middle, the fourth from the base of the upper turbinal. The second, or *bulla lamella*, represents the limit between the frontal sinus and the ethmoid. In case it extends upwards to the posterior frontal sinus wall we have a condition present for a formation of the *bulla frontalis* (Zuckerkandl). In most of our cases the *bulla* is formed after this manner, or by the dilatation of the frontal cell which communicates with the blind-ending infundibulum. The frontal sinus communicates with the frontal prolongation, or with the anterior extremity of the infundibulum; the *bulla frontalis* communicates with the frontal prolongation at the outer side of the ostium frontale or with the infundibulum. In the duplicated frontal sinus we do not have two equivalent cavities in the frontal bone, but one true frontal sinus including a secondary formation, the frontal ethmoidal cell.

The primitive condition of the maxillary antrum consists

in the lateral prolongation of the nasal mucous membrane and of an extension of the cartilaginous nasal capsule in the middle meatus. The original niche of the new-born generally always develops into a large cavity. Frequently membranous, more rarely bony septa traverse this cavity in a frontal or sagittal direction, producing cavities and pockets which divide the original cavity into a number of spaces. These, however, are in broad communication with one another, and a duplication does not result. One specimen of Hartmann's is an exception to this. We found in the lower half of the maxillary antrum two cavities separated from one another by a membranous septum, which did not communicate with or open into the nose. This is not a congenital anomaly, but an acquired formation.

Apparent duplication of the maxillary antrum may result from bony septa following periostitis, follicular dentigerous cysts, or more frequently periosteal cysts. In one of my specimens there is a broad bony plate on the lateral wall of the antrum, the result of an ossifying periostitis. It is very rare that such a bony wall is sufficiently large to cause a subdivision of the antrum. Zuckerkandl gives the drawing of a specimen where a frontal bony septum extends from the floor of the antrum nearly to the orbit. Dentigerous cysts frequently simulate a duplication of the antrum. Five of these cysts were found in 200 specimens. In only three of them were the cysts sufficiently developed to have interfered with the operation from the lower meatus. In one of my specimens the antrum is divided by a bony wall extending obliquely from behind upwards and forwards, dividing the cavity into two spaces—a posterior upper and an anterior lower, non-communicating. The posterior of these communicated with the infundibulum; the lower one had no communication with the nose. A carious root of the first premolar projected into the cavity, and it contained a discolored fluid. This was a case of dentigerous cyst, arising from a diseased root. On the outer surface of the cyst, as well as on the floor of the antrum, osteophytes were present. A connection of this cavity with the nose was not present, consequently it was not one of the pneumatic

cavities. Occasionally a tooth-cyst perforates into the lower meatus. Inasmuch as the accessory cavities develop from typical sites, a cavity in the superior maxilla with an outlet into the lower meatus cannot be regarded as a maxillary antrum.

Cases of duplication of the maxillary antrum have been reported where this point has not been regarded. In one of my specimens, on puncturing from the lower meatus a tooth-cyst would have been entered, while on perforating through the alveolus a healthy antrum would have been tapped.

A duplicated maxillary antrum exists only in those cases where we can prove that a natural communication exists between each of the two cavities with the middle meatus. If, on irrigating each of the two cavities, the water does not run out from the middle meatus, we are probably not in the antrum at all.

I recently had an opportunity to examine a case of supposed maxillary empyema resulting after a tooth extraction. The suppurating cavity, 2 cm deep, was entered from the alveolus. On irrigating, water came through the alveolus, but did not enter into the nose. This proves that the cavity connected with the alveolus was not the true antrum.

Dentigerous cysts which dilate the antral wall are easily recognized. On the other hand, there are maxillary cavities which are divided into two, by frontal, vertical, and horizontal bony walls, each one of which communicates with the nose.

Zuckerkindl found 2 specimens in 300 where the maxillary antrum was divided into an anterior and posterior cavity by a frontal septum, and in another specimen the cavity was divided into an upper and lower space by a horizontal partition. The anterior space in the two former specimens and the lowest in the third communicated with the middle meatus, the upper and the posterior cavity communicated with the superior meatus. Hajek describes two maxillary antra separated by a vertical partition with openings into the upper and middle meatuses. In one of Hartmann's specimens the antrum is divided by a horizontal

partition into a smaller upper and a larger lower cavity. The lower empties into the infundibulum, the upper in the superior meatus. It is peculiar that in all of these cases only one cavity, usually the anterior and the lower, communicates with the nose in a typical situation. The second cavity communicates at a place from which the maxillary antrum never develops. If the maxillary antrum could originate from an extension of the upper nasal meatus, it is strange that no specimen has been seen where the maxillary antrum only communicates with the nose through the superior meatus. Hence we are not justified in regarding a cavity connecting with the superior meatus as a maxillary antrum. The cavities which open into the upper meatus ought to be regarded as ethmoid cells, just as the ethmoid cells of the middle meatus protrude into the frontal sinus as bulla frontalis. Ethmoidal cells of the upper meatus may extend into the maxillary antrum and unite with the antral walls, simulating a duplication of that cavity.

We frequently find small ethmoidal cells extending from the middle meatus into the roof of the maxillary antrum. Zuckerkandl found duplicated maxillary cavities in $\frac{1}{3}$ % of his specimens. We found them in the same proportion. Gruber found in 400 specimens 6, that is, $1\frac{1}{2}$ %. In 1 case both maxillary antra were duplicated. In 2 cases there was an anterior and a posterior cavity, in 4 a superior and inferior. In Gruber's specimens both cavities communicated with the middle meatus.

The sphenoidal cavity is formed by the extension of the posterior extremity of the cartilaginous capsule of the nose and the protrusion of the nasal mucous membrane in the medial anterior surface of the sphenoidal body (*pars nasalis*). The lateral anterior surface (*pars ethmoidalis*) serves to close off the posterior ethmoidal cells. Occasionally in adults a depression or a small groove occupies the place of the sphenoidal cavity. Generally the cavity is large, separated by septa into a number of smaller cavities. Just as in the frontal and maxillary sinuses this septa may reach a sufficient size to close off two complete spaces. Obliquely placed septa have often caused the same mistaken pictures on

sections of the head as in the case of the frontal sinus. In 9 specimens out of 200 the sphenoidal cavity presented two cavities, situated one above the other, of about the same size. These were separated by a partition running obliquely from in front and below to back and up. These two spaces are found in the sphenoid bone unless the sphenoidal cavity occupies not only the body of the sphenoid but also the lesser sphenoid wing. The lower cavity is situated in the true sphenoid body, while the anterior lies in the lesser sphenoidal wing and extends externally to the optic canal. Its roof serves to form a part of the floor of the anterior cerebral fossa. The lower cavity in our cases always communicated with the nasal cavity through an opening in the *pars nasalis* of the sphenoid body. The upper cavity communicated by an opening which appeared under cover of the superior turbinal.

As we regard the true sphenoidal cavity as the one which originates from the typical location, the other spaces which happen to be present must be considered to belong to the turbinals, and form a part of the ethmoid cells. In our cases, therefore, the sphenoid cavity was not duplicated, but we had to deal with the extension of the ethmoid cells in the sphenoid. Zuckerkandl and Douglass have recently studied these spaces in the sphenoid bone. The former found in 12 out of 52 cases a cavity in the lesser sphenoid wing which communicated with the posterior ethmoidal cell. Douglass regards the accessory sphenoidal cavities as sinuses of the lesser sphenoid wing. In one case this sinus opened into the spheno-ethmoidal recess, otherwise his specimens all agree to the description just given. More frequently than a sinus of the lesser sphenoid wing we see the anterior wall of the sphenoid bone pushed inward by the dilated posterior ethmoidal cell, which can be called a *bullae sphenoidalis*. If the sphenoidal cavity be small, the posterior ethmoidal wall may extend in the lesser sphenoid wing. Then the partition between the ethmoid wall and the true sphenoid cavity is not horizontal, as in the case of the sinus of the lesser sphenoidal wing, but vertical. Douglass in 200 specimens found a posterior ethmoid wall extending into the

lesser sphenoid wing in 24 (12 %), and in 7 a fully developed sinus of the lesser sphenoid wing (3.5 %). In our 200 specimens a posterior ethmoidal cell extended into the sphenoid bone in 22 (11 %), and the sinus of the lesser sphenoidal wing was present in 9 (4.5 %).

We have seen that we frequently encounter in the frontal sinus, in the sphenoidal sinus, but rarely in the maxillary antrum, two cavities instead of one. Anatomical investigation has shown that in most cases this is due to ethmoidal cells which have extended to the frontal bone, the sphenoid bone, and the superior maxillary. A true duplication of the accessory sinus due to a division of the rudimentary condition is extremely rare.

ARE THERE "VARIATIONS IN THE COURSE OF
THE FACIAL NERVE HAVING BEARING
UPON THE MASTOID OPERATION"?

By B. ALEX. RANDALL, M.A., M.D., PHILADELPHIA.

(With Text-plate I.)

I N our operative work upon the carious middle ear several of the former bugbears have sunk out of view and it may now be said that the operator often *prefers* to encounter the dura by laying bare the sigmoid sinus and the middle fossa, so little does he fear ill-result from this as compared with the danger of failing to evacuate extradural pus at these points. It remains otherwise with the facial nerve, however; and while we occasionally lay it bare in cases where its function is already destroyed or in other cases curette its carious canal at known risk of causing such injury, it is yet to be sedulously avoided in the great majority of operations. Were it possible by watching for twitchings of the face, as is sometimes claimed, to get timely warning that we are approaching it dangerously, we might rest upon this precaution; but I feel sure that severe and persistent injury is too often inflicted unheralded by any such warning. We must, therefore, base our safety from this distressing accident upon a good comprehension of the anatomy of the parts.

In a recent paper (*A. f. O.*, lvii., p. 96) Schwartze presses further his claims as to variability of the course of the facial canal, and figures specimens which he has prepared to show that the descending portion of the nerve as it passes down may be steep or very oblique in its *outward* trend or may occupy a middle relation—"Schrägverlauf,"—differences which may count for much as to its vulnerability in respect

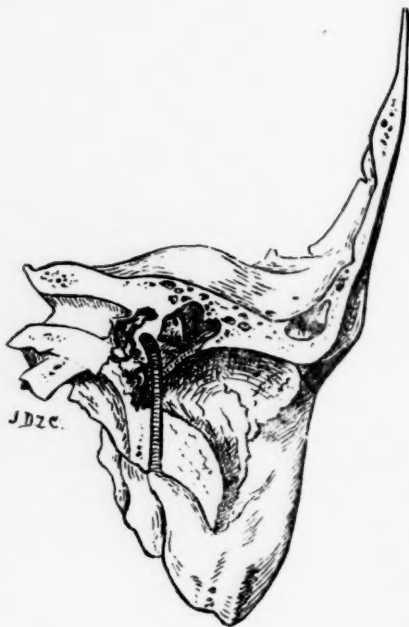


FIG. 1.

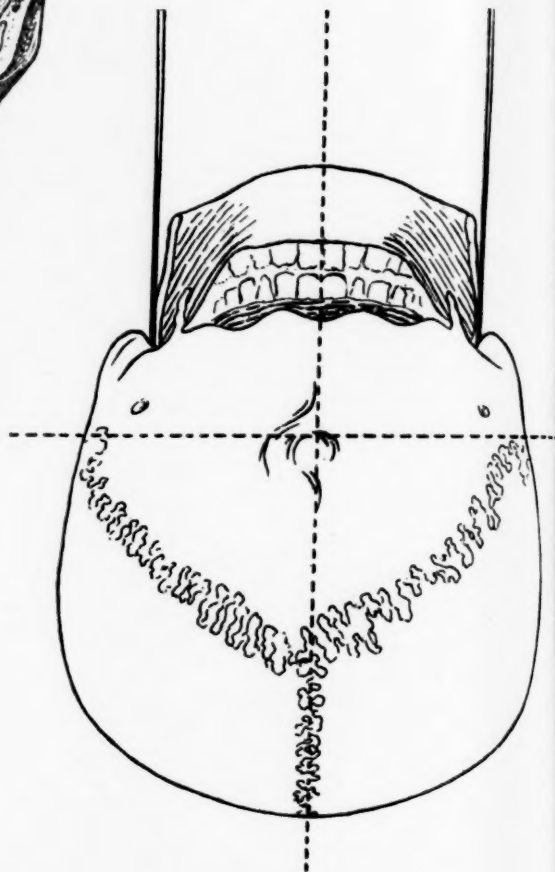


FIG. 2.

FIG. 1.—Posterior half of Temporal vertically sectioned in the axis of the external meatus and with the Facial canal chiselled open to show its relation to the tympanic Annulus (Author's preparation).

FIG. 2.—Skull with Reid's base line and vertical indicated and a probe impacted in the descending portion of each Facial canal.

to the removal of the back wall of the ear canal. "While . . . the Facial lies far internal to the upper part of the *margo tympanicus*, it passes in its downward course so far outward . . . that it can come not only into the plane of the lower part of the tympanic margin (*Steilverlauf*) but even far outside of the lower part of the *margo tympanicus* (*Flachverlauf*)." "The facial can come so near the surface of the mastoid process that even by the first chisel-strokes an injury of it is possible." The latter claim is incomprehensible; but as to an outward course of the facial, others have more vaguely urged the same view, and I believe it is quite generally held.

So far as I know, I stand alone in stating that the descending portion of the facial canal is almost *exactly vertical* (Fig. 1), and forms one of the most *constant* features of the temporal bone. It is by this that we can most surely as well as most conveniently orientate the detached bone. This view has been impressed firmly upon me by all my studies and has long constituted a positive point in my teaching; so the publication of Schwartze's contradictions of it forces me to an immediate review of the question.

As a first step I have measured the first hundred skulls of the Hyrtl Collection in the Mütter-Museum as to the direction of this portion of the canal. To gain the desired information I have simply inserted straight probes into the stylo-mastoid foramina of the inverted skulls (Fig. 2), allowing them to penetrate by gravity if possible and confirming or correcting the accuracy of their placing in the axes of the canals before making a final reading. With Reid's base-line held parallel to a distant horizontal line, it is easy to note the least deviation of the probes from the perpendicular, and then by similar comparison of the skull viewed from the occiput to measure (by a large protractor if desired) any inward or outward direction of the probes. This group of skulls is especially convenient for such mensuration, since they have already¹ been carefully measured in respect to their general configuration and dimensions and especially as to the direction of their external auditory canals²; but I expect to press

¹ *Transactions, American Otological Society*, 1892, p. 235: These ARCHIVES, 1894.

² *Transactions, American Otological Society*, 1894.

the study to much larger numbers before offering more than this preliminary report.

Suffice it now to state that in the sagittal plane the deviations from the exact perpendicular were absent, while they were rather more frequent in the transverse plane of the skull than I had expected, since only 58 of the 100 showed no recognizable departure from this position. In no case was this deviation more than 10 degrees and in but 30 was it more than 1 or 2 degrees; and in 27 of these the direction was *inward* towards the vertebral column, not outward as generally claimed. Taking every case in which the least outward tendency could be assumed, I noted 4 in which it was not measurable, 5 of 1-2 degrees, and only 3 where it was notable — twice 10 degrees and once 5 degrees outward. Even thus much confirmation of Schwartze's claim is worthy of careful consideration; but closer study of these three cases shows that slight over-development of the para-mastoid process had in each encroached slightly upon the exit of the canal, and that the probe did not fairly indicate the really vertical direction of the canal within.

Another point which may enhance but now seems to neutralize all force of Schwartze's claim is brought out in this series of studies. The external auditory canal is the natural structure with which clinically to compare the direction of the facial, since it is in the removal of its back wall that there is most surgical importance in precisely locating the nerve. The direction of the meatus I have shown¹ to vary notably both in the vertical and in the horizontal plane — the extreme differences in each direction being sometimes 20 degrees, with an average direction of 10 degrees upward and 10 degrees forward as it passes inward. This direction seems to vary somewhat with the development of the skull and somewhat with its long-head or broad-head configuration; but to neither of these nor to the estimated direction of the Facial canal has it shown in my studies, so far as they have been carried, any definite relation.

In the paper of Seldon Spencer² to which reference is

¹ *Transactions, American Otological Society*, 1894, p. 87.

² *Medical Bulletin*, Washington University, April, 1902.

made by Schwartz, a diagram indicates a less superficial position of the facial canal in the plane of the front wall of the external auditory canal than near the back wall. This is obviously true, since this nearly horizontal part of the canal parallels the oblique tubo-tympanic axis. The hiatus Fallopii (which nearly represents the position of the geniculate ganglion) I have found on the sectioned skull to be 4 to 8 mm nearer the middle line than is the stylo-mastoid foramen; but a number of measurements have shown no slightest greater distance outward of the exit-point than of the facial prominence above the oval window, and confirm my aforementioned findings. The real source of most of this error which I combat is a misapprehension as to the obliquity of the annulus. Its lower margin is some 6 mm deeper (mesial) than its upper, and the relation to the facial, which Schwartz cites as exceptional and constituting his "*Flachverlauf*," is the *rule*—invariable in dozens of specimens which I have studied as to this point. The lower tympanic margin always lies some 3 mm internal to the corresponding level of the facial, as shown in Fig. 1.

Further, as to the distance of the facial canal posterior to the back wall of the meatus, stated by Schwartz to vary from "directly upon" to 1 cm away, a large number of measurements have found it never less than 2 mm nor more than 4 mm from this wall.

I can only reiterate as my conclusion that the descending course of the facial nerve to its stylo-mastoid exit is in all the cases studied almost exactly vertical and crosses the oblique plane of the drumhead some 3 mm back of the middle of the posterior margin of the annulus. Therefore in removing the back wall of the meatus we should aim to cut a little below the tympano-mastoid suture if we would keep in safe territory.

REPORT OF THE TRANSACTIONS OF THE NEW YORK OTOLOGICAL SOCIETY.

By DR. ARNOLD KNAPP, SECRETARY.

MEETING OF JANUARY 25, 1903. THE PRESIDENT, DR. J. B.
EMERSON, IN THE CHAIR.

By invitation, Dr. A. E. SCHMITT presented **bone specimens and drawings** illustrating the topography and surgical anatomy of the temporal bone. The mastoid cortex was divided into four quadratic fields; the antero-superior corresponds to the antrum, the postero-superior to the sigmoid sinus, and the two inferior to the mastoid cells. The relation of the tympanum and antrum to the neighboring structures was shown, also an osteoplastic method of exploring the cerebellum.

Discussion.—Dr. DENCH thought that the incision shown in the drawings was too small; he had found that it was necessary in doing the radical operation to start the incision well anterior to the auricle, and that it was better to have the descending portion of the incision $1\frac{1}{2}$ to 2 cm behind the insertion of the auricle; he thought that the osteoplastic flap was an excellent procedure for exploration.

Dr. GRUENING questioned the practicability of retaining these squares in operations.

Dr. ARNOLD KNAPP thought that the plates were misleading as a guide to operations because the membranous canal had been cut out.

Dr. DENCH thought that the diagram describing an exploratory antrotomy was excellent, and that there was an indication for this operation, although he had recently seen two cases where he had exposed the antrum and found it more or less free from disease; but the cells below the antrum were filled with pus. The suggestion of packing off the antrum before extending the

operation in a posterior direction, as for exposing the sinus, was not a new one.

Dr. DUEL thought the specimens were instructive from an anatomical standpoint, but hardly in accord with modern operative procedures.

Dr. WILSON gave a further report on a case of **epithelioma of the auditory canal**. This patient, twenty-eight years of age, was first seen in March, 1900. A nodule was removed from the posterior wall of the right canal. It recurred in January, 1901, was removed a second time, and in April, 1902, recurred again. Microscopic diagnosis by three pathologists was epithelioma. Since April, 1902, the patient has been treated with the X-ray; between fifty and sixty applications have been made, the average being two a week. It had been his privilege to examine the case after each application, and he had never seen the slightest reaction on the part of the tympanum. Under this treatment the growth had shrivelled up and disappeared two months ago. There were absolutely no unpleasant effects, and up to the present time there had been no signs of recurrence. Hearing normal.

Discussion.—Dr. HARRIS spoke of a case of lupus vulgaris of the external canal, which he had under observation for one year. This was treated by the X-ray for six months. Slight irritation was caused; the ulceration, however, healed and the process apparently stopped, but the healing never lasted for more than one month.

Dr. HEPBURN said that epithelioma elsewhere was being treated with benefit by the X-ray; he had seen some cases recur of epithelioma about the eyelids, which were benefited by this treatment, and without any reaction.

Dr. DENCH reported a case of **sarcoma of the tympanum and mastoid** in a child aged eighteen months. When first seen there were some granulations in the canal, and paralysis of the sixth nerve. The tissue removed was diagnosed as granulation tissue with an epithelial covering. The mastoid was opened; a cartilaginous, cauliflower-like mass presented, breaking through the temporal bone and invading the dura. This was cleaned out. Microscopic examination revealed an endothelial sarcoma. Recurrence in the depth was expected. The case disappeared from view, and when seen five weeks later the wound had healed and recurrence apparently had not taken place. The patient meanwhile had been treated with the X-ray. Five weeks later the

whole side of the head was very much swollen. He tied the common carotid artery in order to arrest the progress of the growth. This had very little benefit. The tumor is now rapidly growing and is invading the pharynx.

Dr. DENCH also spoke of **facial paralysis** occurring after the radical operation; he had observed some cases where the facial nerve became paralyzed on from the fourth to the tenth day after operation. The paralysis was slight and transient; he thought it was probably due to a neuritis of the nerve. In one case the paralysis was immediate, in which he thought that the chorda tympani had been injured and the traumatism had thus been transmitted to the facial nerve.

Discussion. — Dr. GRUENING had seen four cases of facial paralysis, all occurring after the second dressing, and due to pressure exerted by packing which had been done by an assistant.

Dr. BACON had had a similar experience, and thought the paralysis was due to the packing.

Dr. BERENS inquired if this paralysis was due to the packing, why it did not come on immediately; he thought that most cases of paralysis were due to traumatism or leakage; he also thought that the part of the Fallopian canal over the promontory was the most vulnerable.

Dr. FRIEDENBERG thought the facial paralysis was frequently due to concussion.

Dr. DUEL was of the opinion that the paralysis was brought on by a neuritis, subsequent to either traumatism or infection; he thought that the heat generated by the burr might be responsible, in many cases.

Dr. GRUENING said that the course of the facial nerve is variable; hence, the operator is not to be blamed for paralysis in every case.

Dr. BERENS reminded the Society of the specimen which he had presented a year ago of the anomalous course of the facial nerve, where the nerve was bound to be injured in doing even a simple mastoid.

Dr. KNAPP asked how the sixth nerve paralysis was to be explained in Dr. Dench's first case.

Dr. DENCH thought it was due to inflammation of the dura in the middle cranial fossa.

Dr. FRIEDENBERG had operated on a case and had found

after passing through the mastoid cortex a white, cauliflower-like tumor growing through the bone.

Dr. DENCH thought that if the pressure of the packing caused paralysis, it should be instantaneous and should be relieved by removal of the packing.

Dr. GRUENING had recently had a case of suppurative middle-ear trouble under treatment, which was unusually obstinate; the drum bulged and a **teat-like protrusion** presented with a central opening. He thought these protrusions were unusually difficult to treat. The suggestion of removing this with the cold snare he had found impracticable and he had been able to remove the entire protrusion with the alligator forceps; this was followed by a rapid cure.

Discussion.—Dr. BERENS in some cases had had very good results from the use of the ring knife.

Dr. DENCH thought this was due to proliferation of the mucous lining of the tympanum; he had operated on a case where there was a mass of granulations in the depths of the canal, which he could not remove, but which after the application of strong silver nitrate solution shrivelled to such an extent that he was able to see it protrude through an opening in the membrana tympani. This mass grew smaller and apparently became snared off by nature. He thought it was an hypertrophy of the posterior fold.

Dr. GRUENING thought these cases were not due to proliferation of the mucous lining, and quoted Katz's investigations which showed that the skin layer only about the perforation was involved.

REPORT OF THE TRANSACTIONS OF THE OTOLOGICAL SECTION OF THE NEW YORK ACADEMY OF MEDICINE.

MEETING OF JANUARY 8, 1903. THE PRESIDENT, EDWARD B. DENCH, M.D., IN THE CHAIR.

Dr. W. P. EAGLETON (Newark) presented a case of **cerebellar abscess** with the following history : Boy, æt. fourteen, always in good health, but always had poor memory and did not get along well at school. Six years ago had discharge of pus from the right ear for three weeks followed by abscess of uncertain locality; no scar. Mother said at times a whitish mass protruded from the ear, which was very sensitive to touch. On May 29, 1902, the boy waked in the night with severe pain which lasted three days. On June 1st, was struck on the head by a ball, knocked down but not rendered unconscious. Two days later the ear pain returned radiating over the head, followed in three more days by a flow of foul pus from the ear which lasted a week. During this week he suffered from pain in the head and ear, occasional vomiting, slight attacks of screaming without apparent cause. Probably dizzy, as he would catch at articles in going about the room. Lost flesh rapidly. Indistinct history of a chill; at the end of seven days he became drowsy, and in the next three days seemed dazed and yawned frequently. On the 18th day he was found lying on his right side on the floor, his eyes wide open and apparently blind, in which condition he remained all night and was several times thought to be dying. It was noticed that his arm and leg of the opposite side frequently twitched. The next morning, though still in stupor, he could be roused; he was emaciated, tongue coated, yawned frequently, eyes were wide open, temperature 99.3° , pulse 62. There was slight lateral deviation of the eyes to the opposite side. Pupils were equal and responded promptly to light. The pupil on the unaffected side was observed to dilate more widely

than that on the side of the lesion. There was marked right optic neuritis with beginning left optic neuritis. Absence of both patellar reflexes.

Operation.—Half an ounce of pus was found in cerebellar tissue near the posterior surface of the petrous portion of the temporal. The finger was introduced. Cavity held open by the forceps when the latter accidentally slipped and the flow of pus stopped. Careful search failed to rediscover the cavity. A drainage tube was introduced along the tract. During the next week the boy did well; was rational, no deviation of the eyes, co-ordination normal, but at times he would cry out and there was involuntary defecation and urination. Optic neuritis increased in the left eye and there was nystagmus when the eyes were moved toward the side of the lesion. Seven days after operation, the pulse and temperature being normal, paresis of the arm of the same side developed; the eyes deviated to the opposite side. On the tenth day the wound was explored with the finger but nothing found. On the fourteenth day after operation he was in the same condition as primarily; pulse 66, respiration 14, complete paralysis of arm and hand of the same side. A second operation was undertaken and on exposing the original sinus tract a large abscess cavity was found running towards the median line, from which two ounces of pus were evacuated. After this the hernia, which had developed through the original wound during the first week, disappeared. During the following three weeks the patient was so violent as to require restraint; screamed frequently.

On October 2d, he was discharged; the sinus was healed and has remained so, though twice a small opening has developed over the site of the wound. His mental condition is very poor, though his mother says he is as bright as he ever was.

Discussion.—Dr. JOSEPH COLLINS said it was always gratifying to hear of recovery from brain abscess, whether cerebral or cerebellar, particularly so in the latter as the difficulties surrounding the operation are considerable. He stated that it was the belief and teaching of the neurologist that brain abscess offered a wider field for operative surgery than any other disease upon the central nervous system; in fact, in other diseases of the central nervous system the field of surgery was getting narrower, but in the matter of dealing with brain abscesses it was becoming broader; it still had room to grow. He thought that the conditions that indicated operative interference were fairly well recognized for

abscess, but he wished to emphasize that operation should not be deferred until the appearance of highly pathognomonic symptoms. This, he thought, was frequently impressed upon the neurologist. Speaking of three cases he had recently seen, the first in consultation with Dr. McKernon, he said that in one case the patient had for over a week given signs of brain abscess though there were no definite focal symptoms. An operation was done that same night but the general condition of the patient was too bad then to look for any good result. He thought that if the operation in this case had been done earlier a fairly favorable prognosis might have been made. He brought out the point that the exact localization of the abscess is of secondary importance. From 65 to 70% of all cases show that the abscess is either in the temporal lobe, on a site corresponding to the cause, or it is in the cerebellum. If not found in one place there is nothing else to do but enlarge the opening and proceed to search in the other locality. This was a good rule for brain abscesses except those secondary to lung infection and more rarely those secondary to suppurative processes in remote parts of the body. Dr. Collins further spoke of the fact that otologists did not operate boldly enough in these cases; he thought they, as a rule, made too small an opening in the skull. He cited two cases to illustrate this fact. This he considered a mistake, as nothing was to be gained and much might be lost; a large opening gave better access, was no more dangerous than a small one, and was very little more liable to be complicated with cerebral hernia. The general surgeon, on the other hand, takes away as much of the skull as is necessary, and this procedure Dr. Collins thought should be pursued, so if the abscess is not found in the cerebellum there is already a sufficient opening through which to attack the temporal lobe, and *vice versa*. He thought the following points should be emphasized:

1. Abscess of the brain, wherever situated, is practically a fatal disease, although there are a few recorded cases of spontaneous recovery; these are the exceptions that prove the rule.
2. As all cases die, operation gives the only chance of recovery. There is but one way of dealing with them: enter the skull, evacuate the abscess, cleanse and thoroughly drain the cavity.
3. The cardinal symptoms of localization should not be awaited before subjecting the patient to operation. Operation should expose the most probable seat of the abscess, always bearing in mind

that the location of brain abscess stands in determined relationship to the origin of its causative factors.

4. If necessary, one should "go it blind" rather than wait for focal symptoms, once the mind is made up that there is a circumscribed septic process within the cranial cavity.

In regard to Dr. Eagleton's remarks as to the immediate cause of the abscess in the case presented, he did not think that made much difference, but in regard to his explanation that if due to trauma the abscess was the result of "lowered vitality of the brain," Dr. Collins could not agree with this unless by it Dr. Eagleton meant stasis of the lymphatics. In regard to the best instrument for opening an abscess cavity in the brain, he thought there was nothing better than the clean finger, and he deprecated the use of sharp or pointed instruments. He considered that Dr. Eagleton had dwelt sufficiently upon the necessity for draining these abscesses.

Dr. GORHAM BACON spoke of a case reported in the *American Journal of Medical Sciences*, August, 1895. Male, æt. thirty-one, with chronic otitis media of five years' standing. The drum membrane was destroyed. An attempt was made to secure drainage by removing the granulations, but eventually the patient had to be admitted to the hospital, as he complained of nausea, vomiting, vertigo, lessened discharge, and a tendency to fall to the left. Bone-conduction was almost absent. Mastoid operation was performed, granulations removed from attic and antrum, and drainage established. There was improvement for a week, when vomiting occurred with severe pain in the left side of head from vortex to occiput; slight œdema of right optic nerve; partial nystagmus on turning to either side; stagger to the left; knee-jerks normal; pulse 50-60, temperature not over 99.6°. Cerebellar abscess was diagnosed and an operation performed. The sinus was normal; the temporo-sphenoidal lobe was also investigated. For five days the symptoms were less pronounced, then severe headache with vomiting and restlessness occurred, the vomiting later becoming projectile. The patient tore off bandages, became very noisy; Cheyne-Stokes respirations set in; twitching of left side of face, left arm, and leg with retraction of the head. There was then a remission followed by an exacerbation of symptoms; the patient had lost sensation and motion in the left arm; pupils contracted, double neuro-retinitis. On division of the right cerebellar hemisphere at the autopsy an abscess 4.5 x 3 cm was found,

with a wall 3 *mm* thick, obliterating the corpus dentatum and encroaching on the middle cerebellar peduncle. The third and eighth nerves were compressed. No meningitis. No spot of carious bone was found.

The most prominent symptoms in this case were: pain on the left side, on the side opposite the ear trouble; sudden diminution in discharge; vertigo, vomiting, staggering, falling to opposite side, slow pulse, facial paralysis, optic neuritis. In regard to Dr. Eagleton's case, he wished to ask if the mastoid had been investigated; he thought that in all cases of brain abscess where the patient's condition allows the mastoid should be investigated, first of all and particularly the antrum and attic. After opening the antrum, the bone should be cut away rapidly so as to explore the sigmoid sinus and lay bare the cerebellum.

Dr. PHILLIPS briefly referred to a case he had recently reported in the ARCH. OF OTOLGY, No. 2, vol. xxx., 1901, p. 85. The patient was seen in February, 1900, with a streptococcic mastoid infection. The mastoid operation was done, but later developments required a second operation. The case did well for a few days when he developed severe cerebral symptoms with coma, severe pain, and crying out. There were no signs of optic neuritis and no facial paralysis. The case was considered inoperable, but after twenty-four hours, when the dressings were changed, some pus was discovered at the angle of the knee of sinus, and on slightly pressing the wound with a probe it "slipped into" a cerebellar abscess from which a quantity of pus was evacuated. The opening was enlarged and abscess cleaned out, and without an anæsthetic, as the man was comatose. The wound was kept irrigated with hydrogen peroxide, a proceeding which the Doctor said he could not recommend, and the patient recovered consciousness and became greatly improved and was soon up and about the hospital apparently entirely well. On May 18th he left the hospital and went to work. Some time later he returned to the hospital with high temperature, very violent, and in eight hours after admission was dead. The autopsy showed the correctness of the diagnosis, but scattered over the brain surface were broken-down deposits of pus containing streptococci. The immediate cause of death was, therefore, a general meningitis.

Dr. CHARLES L. DANA said that from the paper presented and from his own reading of other cases of cerebellar abscesses it seemed that there had not been much attention paid to the

leucocyte count, a factor which the neurologist takes into consideration. In otitic abscesses there is, of course, a high grade of leucocytosis, but in trying to distinguish between abscesses and tumors and spots of softening this was an important help in non-otitic abscesses at least. He referred to a case of supposed tumor recently seen in which the leucocyte count of thirty thousand caused hesitation as to operation, and the case was still being watched. He also referred to the value of the X-ray photographs as demonstrated by Dr. Mills, of Philadelphia, who believes that it may be possible to photograph brain abscesses sometimes as well as brain tumors. The photographs are made while the patient is under anæsthesia. Such a process can only rarely be employed in otitic abscesses. Dr. Dana also remarked on the fact that the otologists in their histories did not make the same "status" as the neurologists did, and it seemed to him that no very definitive account of the cerebellar functions was given in otological reports. The neurologist has a definite category of symptoms referable to cerebellar disease and patients suspected of such trouble are most rigidly examined as to their points. Recent investigations in symptomatology have enabled the neurologist to detect disease of this region rather more certainly than heretofore, and he thought that a careful investigation of the cerebellar functions would be an interesting addition to otological case histories. He spoke further of a symptom recently brought out by a French otologist, Dr. Babinsky, of Paris. Dr. B. states that there is a "static volitional equilibrium" and a "motor or cinetic volitional equilibrium," and that the motor equilibrium is maintained longer than the static. It has been found that in locomotor ataxia a person loses both motor and static equilibrium, but in cerebellar disease the patient loses only his cinetic equilibrium—that is, he staggers only while walking; he has the symptoms of what is ordinarily known as cerebellar ataxia—staggering gait, irregular innervation,—but when he is put on his back in bed he is very quiet. When told—while in this position—to hold up an arm or a leg he will make many inco-ordinate movements getting the extremity in position, but once raised he can hold it still, the static equilibrium being rather increased than destroyed; hence in some cases of cerebellar disease there is even a tendency to catalepsy. He referred to a case reported by Babinsky, of cerebellar abscess in which the presence of this static equilibrium was marked, almost to the point of catalepsy, while the motor volitional

equilibrium was much disturbed; Babinsky also cites two other cases reported by otologists, in which patients with cerebellar abscess had this static equilibrium to the point almost of catalepsy.

Dr. MCKERNON thought that cerebellar abscesses caused by ear disease were rarely diagnosed before mastoid operations. In two cases of his own experience the diagnosis was made after the mastoid operation. He considered the definite cardinal symptom was localized, persistent head-pain. In a paper read five years ago he detailed from three cases the symptoms encountered and they agreed with those mentioned by Dr. Bacon. In regard to opening the abscesses, he spoke of two cases he had operated on, in which he had used with great success an instrument devised by Dr. Whiting, the encephaloscope, which enabled him to see the bottom of the cavity clearly. In regard to the cause of the abscess in the case presented by Dr. Eagleton, he was inclined to think that the otitis was the exciting cause, and referred to a similar case of his own, in which the patient was injured while skating. There was no optic neuritis in his cases, and he thought that unless the lesion caused pressure on the optic centres, in recent cases the eyes were not affected. In regard to opening the abscesses, he advises opening as low as possible on account of drainage.

Dr. EAGLETON did not agree with Dr. Collins as to the advisability of at first using the finger for exploration in all cases. In the majority of cases in which operation is undertaken early enough to promise good results, it is impossible to make an exact diagnosis whether the abscess is in the cerebellum or the cerebrum. In these cases the knife should be used; but when it is possible to make an exact diagnosis, or if the knife has either failed or has located the abscess, the finger should be introduced. Replying to Dr. Bacon's question as to whether the mastoid was examined, he said it was not; there was no tenderness in that region, and in his opinion there was no time to be lost in draining the abscess, so the mastoid was not opened. He believed that the important things were to find the pus, drain, and then open the mastoid. He had used the encephaloscope in two cases, and while he appreciated the fact that it might be a very useful instrument in skilled hands, where there was a limiting membrane, it had rendered him no assistance.

Dr. T. R. POOLEY read a paper on **affections of the labyrinth resulting from general and organic diseases** (omitted from

November report). He classified these diseases as follows: cerebral anæmia and hyperæmia, seldom causing serious ear changes; hemorrhagic pachymeningitis, cerebro-spinal meningitis, of which the latter is given as the most common cause of acquired deafmutism; cerebral vascular lesions which may involve the auditory centres; tumors of the brain in which hearing is affected in one thirteenth of all cases; syphilitic growths, to be again mentioned, and spinal-cord diseases which occasionally gave rise to disorders of hearing. The affections of the inner ear attend more or less frequently upon the acute infectious diseases, diphtheria, scarlatina, and measles, which are considered together. Cases of uni- and bi-lateral deafness following these diseases are reported. Influenza also has a tendency to involve the inner ear. The occurrence of ear affections in parotitis has but recently received attention, and Hinton is quoted as saying that the occurrence of deafness from mumps is next to that from scarlatina; other observers, however, do not bear this out. Numerous cases are cited from various observers under this head. Deafmutism is also sometimes attributed to mumps. Aural complications in connection with typhoid, typhus fever, and variola are referred to, and cases are cited illustrating the particular affections which complicate these diseases. In hemorrhagic smallpox the labyrinth is sometimes affected. In considering the subject of inner-ear disease in malaria it is a question as to how much these affections are due to the use of quinine, as this drug has a decided action on the auditory nerves. Syphilitic affections of the labyrinth may be due to both acquired and hereditary syphilis, far more frequently to the latter. They may occur coincident with the eruption or not till many years after, and may also coexist with middle-ear disease of catarrhal origin, this is specially true of the hereditary form. It is the unanimous observation of many authors that in the course of syphilitic affections the development of disturbance of hearing is very rapid. Syphilitic affections formerly ascribed to scrofula were dwelt upon in detail and many authorities cited. The prognosis for hearing in acquired syphilis is better than in the hereditary form. Cases of affections of the inner ear have also been observed in acute and chronic Bright's disease, and Dr. Pooley refers to a case of his own, previously reported. The only statement found as to the frequency of ear disease in nephritis is that by Dieulafoy, who gives 50 %. Uterine disease, hysteria, and some nervous affections are briefly referred to as causing disturbance of hearing.

MEETING OF FEBRUARY 12, 1903. THE PRESIDENT, DR. E. B. DENCH, IN THE CHAIR.

The Exercise of Common Sense in the Practice of Aural Surgery. By Dr. SAMUEL THEOBALD, Baltimore, Md.

Dr. THEOBALD stated that he wished to speak on a few points in regard to common sense, more properly common surgical sense, in otology.

As regards instruments, he thought that the conical nose-piece was very much better adapted for the Politzer bag than the catheter-tip. The latter instrument is likely to give pain or injure the patient's nose. The opening of the bag should be large enough to permit a free current of air. The kidney-shaped pus-basin, as it is generally used, is very bad, because it presents a concave surface where a convex surface should be applied. Again, most of these basins are too shallow. The angular instruments are somewhat faulty, inasmuch as the angle is a bad one, being 140° . He had found that it was very much more serviceable if the angle was 105° or 110° . The reader thought that nowadays the catheter was used too much. This instrument is always very unpleasant, and sometimes painful to the patient. He thought that the old plan of using the Politzer bag should not be given up. The prejudice against syringing in ear disease was without foundation. The younger men of the day are apt to follow certain antiseptic precautions out of proportion with the object sought for. It should not be forgotten that daylight furnishes excellent illumination, and that a dark room with artificial light is not essential. The Doctor thought that the tendency at present was to give the tympanic cavity too much direct treatment, forgetting that most affections in this region are secondary, and that it would be very much better to treat the naso-pharynx and the patient's general condition. Constitutional treatment is very important. It is a fault which the specialist is very apt to commit—namely, to regard all troubles as local.

He had had very good results from home treatment in chronic cases, and thought that very much could be accomplished by proper directions to the patients regarding the use of the syringe, spray, gargle, constitutional remedies, and Politzer bag.

The Valsalva method is at present being less used than it seems right, because the Doctor had found it of value, with the use of the auscultation tube, to detect the patency of the Eustachian tube

or the presence of fluid in the ear. Cerumen can be removed in no better way than by the use of the syringe after the instillation of sodium-bicarbonate solution. The unwisdom of applying irritants to the ear in middle-ear and external-ear troubles is often forgotten, especially in the treatment of aspergillus, where the insufflation of equal parts of boracic acid and oxide of zinc powder has given the reader excellent results.

The reports of monolateral deafness when the other ear hears well are invariably incorrect, as under these circumstances the hearing of the healthy ear cannot be excluded.

In regard to operations, inasmuch as carious bone is not always necrotic, vigorous curetting need not be resorted to, and that by overcoming the cause, instituting proper drainage, antiseptic precautions, and building up the general system, the bone often recovers and an operation is made unnecessary.

The Doctor thought that ossiculectomy should not be done when the hearing is good. He had recently observed a case where the vertigo, nausea, and tinnitus had been relieved by correcting an error of refraction. He thought that the mastoid was being too much operated upon, and that it had become more or less a fixed habit with aural surgeons. He thought that a great many cases did not require operation under the proper treatment. He also wished to protest against the frequency of radical operations where the ear, as far as hearing was concerned, was often made useless.

Discussion.—Dr. J. W. BRANNAN responded to "The General Practitioner's Point of View," and spoke how ten years ago he was struck by the lack of attention and care that was given to ear affections in infectious diseases, especially scarlet fever. He remembered that in his connection with the Board of Health, he had been instrumental in appointing a consulting aurist with great benefit to the ear cases, and at the Minturn Hospital one of the first appointees was a consulting aurist. His house physician in the latter hospital had looked over the records and had found that of the scarlet-fever cases in the first three years 20 % were complicated with otitis, notwithstanding that the best attention was given to the throat. In 1901, 15 % of ear cases occurred, and in 1902, 8 %. The decrease in percentage, he thought, was due to the less severe throat infection. One half of the patients were adults. Ear disease was present in 12 % in the adults and 25 % in the children.

In early years paracentesis was rarely performed; it was only by rise of temperature and the presence of discharge from the ear that the ear condition was noted. Now paracentesis is done at an early stage, with great improvement. In regard to the frequency of operations in his experience he was inclined to think that they were, as a rule, too long deferred.

Dr. HERMAN KNAPP wished to enter a plea for the original Politzer nose-piece in preference to the olive tip recommended by the writer. He thought that by use of the catheter nozzle the air was directed in a straight line to the opening of the Eustachian tube.

Dr. GRUENING agreed with the reader that the otologist should not be too one-sided, and that his efficiency was very much increased if he was able to depend upon the experience of general practice.

In regard to ossiculectomy and radical operations, he thought that less radical methods should be given a little longer trial, but in regard to the acute cases, he was not at all of the opinion of the reader, and he thought that they were not operated on too frequently. There was one cardinal indication for operation, namely, persistent mastoid tenderness.

In conclusion he thought that the consultant was often not as well able to judge of the advisability of operating as the aurist who had had the case in charge, and he was always inclined to side with the latter's opinion for operation.

Dr. MCKERNON thought that the greater use of the catheter in recent years was a great advance in aural practice, and he saw no reason why we should go back to the exclusive use of the Politzer bag; early operations should not be condemned, and in the presence of carious bone it should be radically removed, which is only possible by operation.

Dr. LEDERMAN was of the opinion that the catheter was especially serviceable in cases of one-sided aural affection. Inflation with the Politzer bag acted on the healthy as well as the affected ear. In his experience home treatment had been of little value, and patients who had been intrusted with the use of the Politzer bag were apt to overdo the treatment and cause a relaxation of the membrana tympani. He thought that the mastoid process should be, if anything, more frequently opened by operation.

Dr. SWAIN (New Haven) considered that aural instruments as

a rule were too bulky and he had derived great satisfaction from the use of the paracentesis needle constructed on the plan of the cataract knife. In infectious disease it is often difficult to say whether the fever was due to an ear complication or to some other reason and the right time when to incise was sometimes difficult to determine, especially as in his experience whenever the specialist was called in it was taken for granted that paracentesis should be done.

Dr. DENCH complimented the reader on the excellence of his paper, and stated that he had had the records of the Eye and Ear Infirmary looked over and had found among 64,000 patients that 218 had suffered from a severe intracranial complication and that one out of 88 cases of acute and chronic suppurations had suffered from this severe complication.

Dr. THEOBALD in reply thought that if he were more in favor of the administration of vapors to the middle ear he probably would use the catheter more. He was conservative in opening the mastoid process, and thought that he had been able to accomplish a great deal by proper treatment, which consisted in liberal catharsis and the administration of sodium pyrophosphate.

Dr. HARRIS asked the Doctor to define his views in regard to incision of the membrana tympani and whether he had been able to follow out the subsequent course in his cases.

Dr. THEOBALD thought that paracentesis should be done whenever there was something to be let out—in other words, in bulging of the drum. In the early stages he preferred to wait, and had used the following mixture in the form of ear-drops with great satisfaction :

Atropine, 2 grains ;
Cocaine, 2 grains ;
Oil of sweet almonds, 2 drachms.

A brief report of **forty radical operations for chronic purulent otitis and complications** with remarks by ARNOLD KNAPP, M.D., and C. H. R. JORDAN, M.D. (published in full on pages 81-104).

Discussion.—Dr. C. H. R. Jordan : I have very little to add to the report which you have just heard. It is a simple report about some surgical work which we have done within a certain time, done at least conscientiously and with—as a whole—gratifying results. Yet there is nothing novel nor original about it. The radical operation on the middle ear has passed the experimental

stage long ago. The first timid efforts date back fully fifteen years, and during the following decade the indications and limitations of the new operation were gradually and clearly defined and the details of technique elaborated by the work of many distinguished aurists and surgeons. Since that time the radical operation has been performed on thousands of patients, and wherever it was done by skilful and well-trained hands, the results have been uniformly good. The number of failures has decreased with increasing experience—the failures being more and more confined to conditions which are beyond control of the operator, or to complications which are not within the scope of the operation.

To-day the operation is firmly established as the only reliable means to cure certain dangerous forms of purulent otitis, and we have learned it to be as safe as it is reliable. It must be said, however, that the technical difficulties of the operation are very considerable, and that of all the typical operations performed upon the human body there are few which it is so difficult to do well as the radical operation upon the middle ear. Moreover, the success of the operation depends almost entirely on the amount of skill and care employed in its execution. The average young otologist after having witnessed a number of such operations, or after some little practice on the cadaver, may consider himself qualified to perform it upon the living subject; but he is certainly taking chances, and, if over-confident, is bound to come to grief sooner or later.

I would like to emphasize three points which it is impossible to neglect with impunity.

The first one is a thorough and accurate knowledge of the anatomy of the petrous bone and its surroundings—a knowledge which will enable us to go boldly ahead through diseased or sclerosed bone and open up the cavities of the middle ear thoroughly and with safety to the patient. Such accurate knowledge can only be acquired in one way—by persistent dissecting work on the cadaver.

The second requirement is a high degree of mechanical skill, especially in the use of the chisel. Only with perfect control of the chisel can we give the proper size and shape to our osseous cavity,—without the fear of injuring vital structures. And again, such manual skill is obtainable in no other way except by continuous practice on the cadaver.

The third point is the importance of the after-treatment, which requires skill and gentleness and any amount of patience. The success of the most skilfully done operation would be jeopardized through unskilful after-treatment. If it is the object of the radical operation to throw all the cavities of the middle ear and meatus into one, it is our aim during the after-treatment to keep the obtained cavity wide open and accessible throughout, to prevent the formation of new partitions and pockets, and to help along in various ways the covering of the walls with a permanent epithelial lining. This is frequently a very difficult task, which to accomplish requires considerable experience.

I am well aware of the fact that I am not telling you anything new, at least not those of you who have performed the operation repeatedly and successfully. But for several years it has been my privilege and my duty to initiate students and would-be specialists into the technique of mastoid operations on the cadaver, and I have frequently been amazed at the confidence with which they attempted to do the radical operation on the living subject after a short course of instruction. I recall several instances where the direct results of such an over-confidence—meningitis and facial paralysis—were fearful to behold. Such accidents go a long way towards discrediting with the profession and with the general public an operation which if properly performed should win unlimited praise.

Dr. PHILLIPS said that the placing of the indications for the radical operation was often very difficult, especially when the double operation seemed necessary. The operation is sometimes insisted upon by patients. In two recent operations upon young women both had insisted upon operation because told that the odor would disappear. He was in favor of exercising conservatism by all means and thought that the operation should not be attempted by aural students unless preceded by a thorough course of training on the cadaver.

Dr. MEIERHOF thought that the indications for the radical operation abroad were more frequent than in this country. This was partly due to the fact that the patients abroad were more apt to be tuberculous and poorly nourished. Many cases even of the very chronic type could be cured by persistent attention to details in keeping the tympanum clean, for if by constant wiping out not the canal but the tympanum cavity with dry cotton mops, six to eight times daily on the part of the patient or attendant, a

shrinking of granulation tissue and thickened mucous membrane took place, better drainage through the aditus from the mastoid antrum would be assisted, thus aiding nature to bring about a cure. Of course, this can only be done when there is a large opening in the tympanic membrane either as the result of disease or art. Where the discharge is scanty, syringing is sparingly done, as he has found constant syringing to maintain or favor granulations. Boric acid in alcohol poured into the ear twice daily is still a useful addition to the dry mopping. However, there will remain some cases that will require radical treatment in spite of all conservative measures.

BOOK NOTICES.

IV.—**Bericht über die neueren Leistungen in der Ohrenheilkunde.** Von Dr. LOUIS BLAU, Specialist for Diseases of the Ear in Berlin. Leipzig, Verlag von Hirzel, 1902.

This is the *fifth series of general reviews on the progress of otology*, by Dr. L. Blau, comprising the literature of the years 1897–1900 in systematic arrangement. They have acquired the reputation of being the very best of their kind, a judgment heartily endorsed by the reviewer. The present report is a neatly printed volume of 330 pages, containing the following parts:

I.—*Anatomy and Physiology*, pp. 2–36, treating chiefly of the inner ear, criticising Helmholtz's theory of sound perception (Beckmann and Zimmermann). The function of the tensor tympani muscle is considered by HAMMERSCHLAG, in agreement with Hensen, Bockendahl, and Pollack, to be a reflex action, a convulsive motion from sound excitation. Opposing this view, OSTMANN considers the tensor tympani as a protective apparatus of the ear, like the sphincter of the pupil.

The stapedius muscle, according to Ostmann, is the true apparatus of accommodation of the ear.

CYON pretends that the semicircular canals are the organ of equilibrium only in so far as they enable animals to orient themselves in space: man and other animals with three pairs of semicircular canals have a conception of a three-dimensional space; animals with two pairs of semicircular canals, for instance the river-lamprey, lamper-eel (*Petromyzon fluviatilis*), have sensations of two dimensions only—up and down, or forward and backward; whereas animals with only one pair of semicircular canals, as the Japanese dancing-mouse, orient themselves only in one direction—right and left. Helmholtz's theory of tone sensations has been modified by Ebbinghaus in so far as the single fibres of the basilar membrane do not vibrate only as a whole but also

by the formation of nodes, causing an excitation of the fundamental tone and its harmonics, which may be taken up by the manifold splittings of the ends of the acoustic nerves and carried to one cell in the spiral ganglion, according to the anatomical investigations of Held.

Other theories of sound perception are detailed: Gray's, Rutherford's (the telephone theory), Ewald's, Dennert's who proved that tone and noise were not fundamentally different sensations (*Arch. f. Ohr.*, xlv., p. 27, 1898).

II.—*Pathology and Therapeutics.*

A. *General Hearing Tests*, pp. 37-106.—Statistics and etiology of ear diseases.

Ear affections in scarlet fever, diphtheria, measles, influenza, mumps, tuberculosis, epidemic cerebro-spinal meningitis, brain tumors, diabetes, endocarditis, rachitis, leukæmia, pernicious and simple anæmia, purpura, nephritis, tabes dorsalis (changes in the peripheric unravelling of the primary neurons of the cochlear nerve). Another category of auditory affections in tabes is the apoplectic deafness (Ménière's disease), referred to a disease in the nuclei of the acoustic in the medulla oblongata. Further, there are detailed the ear diseases in hysteria (including traumatic neuroses) and syphilis. Then follow a general symptomatology and therapeutics of ear disease.

B. *The External Ear* is treated in the same way, reviewing carefully the publications during the period of three years.

C. *The Middle Ear*, with its connections and the complications of its diseases, their diagnosis and treatment, occupies the greatest and most elaborate part of these detailed reports of actual cases and observations, with the author's views on many differences of opinion presented in sufficient detail and with unbiassed judgment.

D. *The Inner Ear*, pp. 305-330.—After some general remarks, the author describes the injuries of the inner ear, Ménière's symptom-complexus, labyrinth-necrosis, disease of the auditory nerves, and deafmutism.

Any aurist if possessing only a reading acquaintance with the German language, will be delighted with the thorough, scientific and practical digest of the newest works on otology.

HERMAN KNAPP.

MISCELLANEOUS NOTES.

Announcement of the Seventh International Otological Congress.—The French Committee charged with the organization of the Seventh International Otological Congress has determined that the meeting shall be held at Bordeaux, France, from the 1st-4th August, 1904. At the head of the bulletin the following questions has been selected for general discussion :

1. *Choice of a simple and practical Acoumetric formulæ.*
2. *Diagnosis and Treatment of the Suppurations in the Labyrinth.*
3. *Technique of the Opening of Otogenous Brain-Abscesses and their After-Treatment.* The latter will be introduced by Mr. MACEWEN, of Glasgow, Mr. SCHMIEGELOW, of Copenhagen, and others.

President, Dr. E. J. MOURE, Bordeaux; General Secretary, Dr. LERMOYEZ, 20 bis, rue de la Boétie, Paris (8^e); Treasurer, Dr. LANNOIS, 14 Rue Emile-Zola, Lyon.

ERRATUM.

Dr. WENDELL C. PHILLIPS desires to state that among the micro-organisms to be known as producers of suppuration in the middle ear, the smegma bacillus described by him at the end of page 3 in the February number, 1903, of these ARCHIVES, was mentioned before him by CIMA as observed in the otitis media of little children, and published in the *Arch. ital. di otol.*, ix., 1, p. 72, 1899.

Fig. 1.

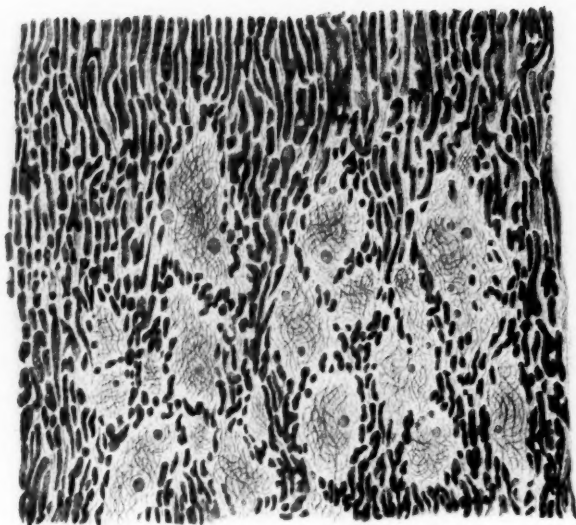


Fig. 2.

